

**BUILDING ON THE WIRELESS REVOLUTION:
OPPORTUNITIES AND BARRIERS FOR SMALL FIRMS**

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WEDNESDAY, FEBRUARY 11, 2014

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SMALL BUSINESS,
Washington, DC.

The Committee met, pursuant to call, at 1:00 p.m., in Room 2360, Rayburn House Office Building. Hon. Sam Graves [chairman of the Committee] presiding.

Present: Representatives Graves, Chabot, Luetkemeyer, Herrera Beutler, Collins, Velázquez, Chu, Payne, and Meng.

Chairman GRAVES. Good afternoon, everyone. We will call this hearing to order.

I want to thank our panel of witnesses for taking the time out of their full-time jobs to make the trip to Washington for this very important hearing.

In today's hearing we are going to examine one of the most dynamic and innovative industries in the United States—wireless technology. The wireless industry continues to grow at an exponential pace, largely due to the constant state of innovation in the sector. Now, home appliances can be operated by smartphone, farmers can monitor soil conditions from afar, and vehicles can nearly drive themselves. These are just a few examples of the innovations being developed and used by small firms with wireless technology.

The increase in connectivity of devices to each other, commonly referred to as the Internet of things, has the potential to be a game-changer. According to a McKenzie study, over one trillion things could be connected through technology by 2025, resulting in a potential economic impact of \$36 trillion. This means thousands of new jobs created by small, innovative firms, as well as a variety of industries, and new tools for small businesses to improve their operations.

While it is easy to understand the benefits of this emerging industry, these technologies depend on sufficient access to spectrum and reliable wireless network to operate effectively. As the demand in wireless services continues to grow, the Federal government must work to reallocate unused spectrum to make it more available to wireless broadband and innovative devices like these. It is also important to note that these opportunities would not be available if not for the investment in broadband infrastructure by private sector carriers.

To bring these products to the market, small businesses must navigate an assortment of challenges, including financing, marketing, and regulations. We are interested to learn more about these innovations, as well as the barriers to developing and using these technologies that small firms and farmers are experiencing.

Again, I want to thank all of our witnesses for being here today. I now recognize Ranking Member Velázquez.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

Wireless connectivity is transforming our daily lives by revolutionizing health care, education, public safety, and nearly every other economic sector. With almost two-thirds of cell phone users now utilizing their phones to shop, conduct business, or surf the web, it comes as no surprise that the wireless industry is expected to soon be valued at \$25 billion. Such rapid industry growth will account for an estimated 500,000 jobs. It should also come as no surprise that entrepreneurs are among the most technology-savvy consumers. Small firms increasingly find innovative ways to access and tap markets through low cost voice and videoconferencing. Many small businesses are utilizing social media to interact with consumers and market their products and services. Not only is this technology helping small firms reach new customers, but the very nature of office efficiency has been changed. Novel innovations empower business owners to track productivity gains, reduce paperwork, and better meet customer needs. In fact, wireless technology has become so central to business operations that 65 percent of small firms say they will struggle to survive without it.

The most successful businesses are not just the ones adopting new products and software, but they are also those developing new technologies. In just a few short years, developers have created millions of apps, and this number continues growing exponentially. The vast majority of these designers and developers are small firms. One study found that 78 percent of developers are small businesses with many having fewer than 10 employees.

Despite recent gains, the wireless sector faces several challenges to continued growth, such as regulatory uncertainty, cybersecurity, privacy issues, and capital infusion. The most contentious and immediate obstacle to wireless innovation appears to be access to sufficient spectrum. Spectrum capacity is necessary to deliver high speed, high quality communications to consumers and businesses of all types but this ever-increasing demand for mobile broadband is causing a spectrum crunch.

As technology improvements alone cannot solve this problem, changes to spectrum policy will likely need to be addressed. One such issue is ensuring the FCC conducts spectrum auctions in a manner that is fair for small firms. Balancing the needs of all parties is important for guaranteeing industry competition. For this reason, I applaud Chairman Wheeler's announcement to postpone the auctions until they can develop an adequate process that meets objectives like this.

At today's hearing, we will also touch on the use of unlicensed spectrum and its role in sparking innovation. Unlike licensed spectrum, unlicensed spectrum is available to a wide audience at relatively lower costs. This valuable communications resource is estimated to generate \$15 billion a year for the U.S. economy. As it

is a critical platform for entrepreneurs to use in developing their products, I welcome making more of this spectrum available to foster yet more entrepreneurship and innovation. Just as today's hearing will focus on small business innovation in the mobile technology industry, it will also give us a chance to hear the challenges these businesses raise and their thoughts on the spectrum crunch. The insights gathered today will help ensure the needs of small firms are taken into account in future FCC spectrum auctions. I do not think it is an overstatement to suggest our country's continued competitiveness in the technology sector depends on this process functioning fairly and smoothly.

In that regard, I thank the witnesses for contributing to this valuable discussion, and I yield back the balance of my time.

Chairman GRAVES. Thank you.

Our first witness is Michael Feldman. He is a vice president of Engineering with BigBelly Solar Company. BigBelly develops and manufactured solar-powered trash cans with sensor technology for efficient waste management. They were recipients of Verizon's Powerful Answers award at the 2014 Consumer Electronic Show for their work in sustainability.

Thanks for being here, Mr. Feldman.

STATEMENTS OF MICHAEL FELDMAN, VICE PRESIDENT OF ENGINEERING, BIGBELLY SOLAR; BRIAN MARSHALL, OWNER, MARSHALL FARMS; LEO MCCLOSKEY, SENIOR VICE PRESIDENT, TECHNICAL PROGRAMS, INTELLIGENT TRANSPORTATION SOCIETY OF AMERICA; DARRELL WEST, VICE PRESIDENT, GOVERNANCE STUDIES, DIRECTOR OF TECH INNOVATION, BROOKINGS INSTITUTION

STATEMENT OF MICHAEL FELDMAN

Mr. FELDMAN. Thank you, Chairman Graves

Chairman Graves, Ranking Member Velázquez, and Committee Members. My name is Michael Feldman, and I am vice president of Engineering at BigBelly Solar.

BigBelly Solar was founded in Newton, Massachusetts, with the mission of reducing CO2 emissions from gas-hungry garbage collection vehicles by eliminating unnecessary miles driven. A standard garbage truck gets three miles per gallon and in the United States alone, with an estimated 180,000 garbage trucks traveling the roads, they collectively consume over one billion gallons of fuel while contributing 18 million tons of CO2 into the atmosphere each year. That is the equivalent usage of an Exxon Valdez oil spill every four days, and this does not include the congestion and nuisance they cause amongst our city streets and roadways. By reducing, or even eliminating, unnecessary driving miles, we can significantly cut this usage pattern. As we like to remind people, the cheapest and cleanest mile is the one never driven.

Manufactured in Lexington Kentucky, the BigBelly Waste and Recycling System provides a unique combination of information technology software, solar power, and on-site compaction at public space locations. By compacting the waste, which increases storage capacity, we are left with a trash can that does not require emptying as often. In fact, a BigBelly is capable of holding five

times more waste and is more intelligent than traditional trash cans. This reduces collections on average from twice a day to approximately once every other day. Furthermore, utilizing solar energy to power the compaction mechanics allows a BigBelly to be placed virtually anywhere without the need to connect to the electric grid.

BigBelly has been an early champion and recognized leader in the growing machine-to-machine (M2M) marketplace. A significant part of the BigBelly solution incorporates wireless technology to transmit data from the trash receptacles to a central database for processing. Users of the system access this data from a simple and easy to use web application that provides important information, including which cans need to be emptied, historical reports and analytical reports. There is even a mobile application for smartphones and tablet devices.

This technology used is very similar to that found in modern cell phones today, only instead of calling another person, the BigBelly calls another machine. Here is how it works. Each BigBelly trash compactor is equipped with a series of electronic sensors, solar panel, a battery, and an internal computer. The solar panel is used to keep the battery charged which drives the compaction mechanisms. A compaction is triggered when the trash level inside the bin crosses a sensor beam. As more waste is deposited, this process continues until the internal computer determines the bin is full. The computer will then use the wireless network to transmit the fullness data to a central computer system, where users can see that the bin needs to be emptied. Trash cans have never been smarter.

Today, you can find a BigBelly in every state in the United States and exported to over 40 countries around the world. Our product can be seen in cities and towns, both large and small, colleges and universities, military bases, national parks, and government agencies.

Like all small businesses, we are not without our share of challenges. We are a small company of 40 employees. For any business wishing to connect wireless devices, telecommunication industry certification costs upwards of \$30,000 before they will allow new devices to connect to their network. While we certainly are in full agreement and have no issue with the intent and protection the carriers require, in many instances we found these tests were aimed at cell phone-style devices, not M2M devices, such as BigBelly. After all, you cannot hold a BigBelly up to your ear.

Likewise, federal assistance for energy efficiency community block (EECB) grants has run out. This is most unfortunate as it enabled municipalities to participate in new green technologies, such as BigBelly, that have proven dividends not only to the town's balance sheets and budgets, but to the environment as well. Your sponsorship, endorsement, and legislation assisting environmental and wireless technology products like BigBelly and creating new or similar programs such as the EECB will benefit all Americans. Furthermore, cash strapped cities and towns are unable to apply for and receive solar energy credits for the deployment of a BigBelly solar system.

As explained earlier, our use of solar and wireless technology allows the BigBelly product to operate out of the reach of the electric grid. However, solar energy grants only apply to products that connect to this grid. Given this positive dollar savings, environmental, and economic impact this class of product has, we ask the Committee to research and investigate how these solar credits are dispersed and to implement changes that could incorporate new solar and wireless technologies like BigBelly that would enable your cities and towns to receive these credits.

In closing, I would like to thank the members of the Small Business Committee for allowing me the opportunity to present the BigBelly story and provide insight into how we are using wireless technology to save real budget dollars and make a tangible impact on the environment one trash can at a time.

Chairman GRAVES. Thank you, Mr. Feldman.

Our next witness is Brian Marshall. Brian is a full-time family farmer from DeKalb County, Missouri. Together with his family he grows corn, soybeans, and wheat. Brian uses a variety of wireless technologies to increase the efficiency and productivity of his operation, and he is chairman of the Young Farmers Committee with the Missouri Farm Bureau. He is testifying on behalf of the Missouri Farm Bureau Federation and the American Farm Bureau Federation (AFBF).

Thanks for being here, Mr. Marshall.

STATEMENT OF BRIAN MARSHALL

Mr. MARSHALL. Chairman Graves and Ranking Member Velázquez, Members of the Committee, thank you for the opportunity to testify on behalf of the American Farm Bureau Federation and the Missouri Farm Bureau Federation.

I am here today to discuss how the advancement of technology is affecting modern agriculture. My farm is about an hour north of Kansas City in Maysville, Missouri. Both of my grandfathers farmed in the Maysville area, as does my father today.

I am going to share with you about some of the technologies we are using on our farm, and I hope to offer some perspective from my fellow Farm Bureau members as well.

When I came back to our family farm, I did not envision being the new tech guy. That role has become a large part of my responsibilities as our farm and the use of technology has grown. On our farm, we use GPS on three tractors, two combines, and the application rig we use to apply crop protection products. This rig I mentioned is also equipped with auto steer. Allowing a computer to guide the machine increases accuracy and allows me to more closely monitor its performance. Our rig is also equipped with a new method of application that uses a computer to manage the droplet size based on the product being applied. This keeps a consistent pattern at any speed and the chances of offsite application are greatly reduced.

The most important piece of equipment on our farm is the planter because it is very difficult to fix a poorly planted crop. We have added aftermarket parts, such as a precision monitor, to track everything from seed placement to the amount of force that is used to put the seed in the ground. I also have an iPad that is synced

to my planter monitor, running software that allows me to do real-time mapping and data analysis right there in the field.

When any farmer plants an irregular-shaped field, the potential for overplanting goes up. As planters have increased in size, so, too, has the chance for using too much seed in these fields. To reduce this problem on my farm, we have equipped our planter with row point clutches. The clutches use a GPS signal to shut off when crossing into any part of the field that has already been planted. Not only does this save seed cost, but it helps eliminate yield loss from plant overcrowding in double-planted areas.

I mentioned to you earlier that three of our tractors are equipped with auto steer. At \$10,000 per machine for an economy system, it is not cheap to put auto steer on a tractor. All of the technology we have discussed did require a sizable investment. However, we feel that through the savings in input costs and operator fatigue, we have more than paid for these investments.

Recently, Dad and I met with an agronomist to address what is known as “prescriptions” for our farm. Many farms across the Midwest have soil types and yield potential that vary widely. Our land is no different. With the technology available today, we can merge several years’ worth of data to get a more complete picture of what is going on and then make more accurate decisions for every farm and every acre on that farm.

Not that long ago, it took careful planning and a support team to do tedious tests just to generate a fraction of the data that we are able to get access to right now from the field, even in a combine. The new technology will undoubtedly help make farmers more efficient and allow the use of fewer inputs while increasing their overall level of output. The amount of real-time information gained at a micro level is a big change that has taken place within the last two years and is of concern to our organization. We refer to this issue as “big data.” From Farm Bureau’s perspective, one of the most important issues related to big data goes directly to property rights and who owns and controls this data. In addition, since the farmer’s information is valuable to these companies, farmers should have a say in and be compensated when their data is sold.

There is a real need for farmers to protect their data and make sure they bargain wisely as they share their data with suppliers and companies who desire to access their information. AFBF is working to convene formal discussions with all interested parties with a goal of security cooperation on this emerging issue among farmers, companies, and other production chain stakeholders.

The future looks very impressive in terms of technological advancement in agriculture, but we should not overlook the gaps that exist, particularly in rural areas. I find it ironic that I can upload yield data in real-time from my combine to the cloud as I am shelling corn, yet it can be difficult to watch local programs on television or have a cell phone conversation in my area.

I encourage the Committee to share these concerns and the policies adopted by my fellow Farm Bureau members with the Federal Communications Commission since they affect farmers and other small business owners in rural areas as well.

As I have learned by attending meetings and conferences, what works on my farm may not necessarily be practical for my neighbor. America's farms and ranches vary in size and scope, and farmers need a variety of tools in the toolbox. I do not expect you to share my level of enthusiasm for real-time data collection, but I hope you are excited about farmers' use of technology to increase efficiencies, better manage their inputs, and ultimately, to help us better serve consumers from my hometown all the way to New York.

Thank you.

Chairman GRAVES. Thanks, Brian.

Our next witness is Leo McCloskey, senior vice president at the Intelligent Transportation Society of America. Leo recently joined ITS America from a small firm, Airbiquity, an industry leader in connected vehicle technology. He has nearly 20 years of experience in this industry, including leadership positions in multiple small technology firms.

Thanks for being here.

STATEMENT OF LEO MCCLOSKEY

Mr. MCCLOSKEY. Thank you. Chairman Graves, Ranking Member Velázquez, and Members of the Committee, thank you for the opportunity to testify about the merging of transportation and wireless network connectivity, how it benefits the overall economy and provides opportunities for small business.

I am honored to share my views on behalf of the Intelligent Transportation Society of America, which brings together public agencies, private industry, and academic experts to advance technology solutions to the nation's transportation challenges. More than half of our nearly 500 members are private sector companies, including major automakers, high tech, telecomm, tolling, and infrastructure firms, as well as entrepreneurial small companies who are propelling innovation forward in transportation.

I would like to speak with you about the wireless technologies in two distinct areas. The first area is the importance of transportation technologies for businesses of all sizes and why building smart technology into the nation's transportation system is a smart investment. The second area pertains to technology innovations in transportation services, which are being driven by entrepreneurs and small businesses.

The performance of our nation's transportation system is critical to the overall health and competitiveness of our economy. The objective of a transportation system, especially our national one, is to make the journey from origin to destination as efficient as possible, whether it be for a product or a person. Predictability in transparency in the transportation journey and across the supply chain is essential for businesses to adequately plan their operations. Unexpected delays in shipping and receiving costs money and jobs. As we have all experienced, our national transportation system is pretty darn congested. According to the Texas A&M Transportation Institute, the annual financial cost of congestion is over \$120 billion a year, wasting more than 5.5 billion hours and \$3 billion in fuel costs, while pushing an additional \$56 billion pounds of emissions into the atmosphere.

While much of the investment required to restore our system will go towards roadways, bridges, and public transit, nearly every new transportation project should also contain a significant technology component. Research has shown that investments in technology from adaptive signals that control traffic to electronic toll collection have a greater return on investment than traditional infrastructure projects, while providing a safer, more efficient transportation network for businesses and the traveling public. For example, a small business like Lifespan Technologies, which is in Georgia, has developed wireless sensors that provide a detailed indication of bridge infrastructure health and can direct engineering activity to where it is most needed. Such technology pinpoints problems while removing the guesswork that comes with only visual inspections.

Another small business driving the transportation technology industry forward is Savari Networks in California, which supplies the wireless technologies enabling cars to communicate with other cars, as well as the surrounding transportation infrastructure which is intended to prevent crashes. They are now expanding into Detroit and expect to double in employee size this year.

Small businesses like Streetline, Park Mobile, and Parkopedia, are busy at work hiring staff to help rid the world of wasted time trying to locate parking. Using wireless technologies, each brings innovation to a very common problem that creates an average of 30 percent of city traffic congestion.

And finally, I would be remiss without noting that many entrepreneurs are now expanding the shared ride market. Companies like Uber, Car2Go, Lyft, and RideScout are making it simpler and cheaper to go from one place to another. There are jobs in software development and service operations in all of these companies, and there are real supply problems they are solving—the efficient movement of people from origin to destination.

But there are also many drivers—hard-working, licensed drivers—who can now operate as independent businesses, as small business owners and operators. If we consider our nation's demographics over the coming decades, providing sensible transportation to a growing segment of the population, one which would still benefit from mobility services, as well as from much-reduced risk to themselves and others while in mobility, it would seem an industry worth encouraging. The key challenge though is collecting accurate, real-time data about the operations of the transportation system in a manner that maintains anonymity and advances the deployment of transportation technology.

As you can imagine, the data from a communicative transportation infrastructure is valuable to many parties. For example, states and cities need better data to manage traffic and target investments to where the needs are greatest. Fleet operators and shipping managers could use the data to dynamically adjust routes and better maintain on-time performance, and first responders could use the data to avoid route congestion or gain traffic signal priority.

In short, data creates opportunity and the likelihood of more jobs, making investments in intelligent transportation systems a very smart investment for all parties.

Thank you again for the opportunity to testify, and I look forward to answering your questions.

Mr. LUETKEMEYER. [Presiding] Thank you, Mr. McCloskey.

And we will have the ranking member introduce our next guest.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

It is my pleasure to introduce Mr. Darrell West, vice president and director of Governance Studies and founding director of the Center for Technology Innovation at The Brookings Institution. He also holds the Douglas Dillon Chair of the Institution. His current research focuses on technology, mass media, and public sector innovation.

Prior to Brookings, Mr. West was the John Hazen White professor of Political Science and Public Policy and director of the Taubman Center for Public Policy at Brown University.

Welcome, and thank you for being here.

STATEMENT OF DARRELL WEST

Mr. WEST. Thank you very much, Chairman Graves, Ranking Member Velázquez, and other Members of the Committee. Thank you for the opportunity to testify here today.

So as you have heard from my fellow witnesses, wireless communications are growing dramatically and are vital for economic development, health care, energy, agriculture, transportation, and a number of other areas. I have already learned something new here today. I did not realize that we had smart trash cans. I could use a few of those in my D.C. neighborhood, so I think that is a good idea.

There are tremendous opportunities for small businesses in a number of different areas if we can overcome the obstacles that currently exist. Small firms face a number of different problems in the areas of regulation, spectrum availability, infrastructure, and access. But there are several steps that we can undertake that would make a big difference for small businesses. Perhaps the most important issue to address is the question of spectrum availability. According to the FCC, we need a minimum of 300 megahertz for mobile technology over the next five years, and 500 megahertz overall, including both mobile and other uses of spectrum, in order to accommodate the growing use of smartphones, tablets, and mobile broadband.

We need a balanced spectrum policy that includes both licensed and unlicensed spectrum. Currently, there is a mismatch between spectrum supply and demand. We need market-based auctions for reallocating scarce resources in spectrum auctions. There are a number of organizations, both public and private, that are sitting on unused spectrum, and so we need to develop mechanisms to reallocate them to higher priorities.

We know that the FCC currently is working on specifications for the upcoming auction. We recommend that legislators should make sure that small businesses have a fair shot at competing for unused spectrum, and also that entrepreneurs from diverse walks of life have an opportunity to bid on the spectrum. We think that unlicensed spectrum should be an important part of what we need to emphasize here. There currently are a number of innovative small business services that make use of unlicensed Wi-Fi. Consumers

can access a wide range of digital services at coffee shops, in airports, and through business establishments around the country.

According to a SYSCO study, 55 percent of all Internet protocol traffic is expected to run over Wi-Fi networks by 2017. A number of Internet service providers are moving their service delivery to Wi-Fi hotspots, and so therefore, improving availability to unlicensed spectrum through the 5 gigahertz bin will alleviate some of the current spectrum.

There also is underutilized bin in the 3.5 gigahertz band. It is possible to turn some of this low power segment into a citizen's broadband service. Right now it is deployed for naval radar utilization, but it could be used for civilian purposes in geographic areas where the Navy does not operate. And so this is an example of spectrum repurposing that would allow people to take much more effective use of those networks.

We need to make more efficient use of existing spectrum. We need to determine ways to take advantage of the spectrum that we have. There have been advances in cognitive radio applications that are designed to make more efficient use of current resources. Scientists are working on ways that allow multiple, noninterfering uses of various bandwidths.

We need infrastructure improvements. There are new applications in a variety of areas that require high speed mobile broadband. We need to improve our data sharing networks and promote wireless connections that take advantage of these new developments. We also need to encourage local communities to streamline the approval process for building new cell towers and laying fiber optic lines because right now communities have a wide range of different rules depending on the area.

The last point I will make is we need to encourage higher broadband adoption among underserved populations. About 30 percent of Americans lack home broadband access, and for these underserved populations there are a variety of things that we should do to improve adoption. We could adopt digital literacy programs, improve market competition to drive down consumer costs, and develop outreach programs designed to help bridge this digital divide. So with these actions, I think both consumers and small businesses would have better opportunities to gain the benefits of the mobile economy.

Thank you very much.

Mr. LUETKEMEYER. Thank you very much.

With that, we will begin the questions with Mr. Collins. He has five minutes.

Mr. COLLINS. Thank you, Mr. Chairman.

Mr. Feldman, I am really—by the way, thank you all for coming today. I am kind of intrigued by your product. How long have you been making it?

Mr. FELDMAN. BigBelly actually started in 2003, and first started really getting traction in the City of Philadelphia, I believe, was the first major deployment, and that was around 2008.

Mr. COLLINS. So is it one size or do you have multiple sizes?

Mr. FELDMAN. What there is, we call it a station. There is a mailbox-sized trash compactor. The compactor does the compaction, obviously. And on the recycler side there is actually sonar inside

that can sense the height of the trash. Either of those can trigger a fullness notification.

Mr. COLLINS. But is it a one-size trash can?

Mr. FELDMAN. Yes. It is a 30-gallon trash bin and it holds 150 gallons of waste.

Mr. COLLINS. Now, sometimes you have garbage trucks that have the arms that pick it up and dump it. Could you do that or does it have to be manually?

Mr. FELDMAN. Today it is manual. They unlock, open up a door. It is an enclosed system. And they open up a door. The collector takes it out, picks up a bag, puts it in the truck like you would normally see.

Mr. COLLINS. Is that sometimes an issue with some cities that do the automatic?

Mr. FELDMAN. We have requests for lift arm capabilities and that is something that we are currently in development working on.

Mr. COLLINS. So without giving away trade secrets, what is the ballpark price on one of your units?

Mr. FELDMAN. \$2,995. \$2,995 for the compactor.

Mr. COLLINS. Did you see a fall off—if there were the credits as you talked about that have now expired, what would be a typical credit and how much of an incentive was that for the municipalities?

Mr. FELDMAN. Back in the day it was a very large incentive to get our business going and to be what I would call a market maker. I do not know that I am qualified to answer what impact that would have, and so I can defer that question and certainly get back to you with an answer.

Mr. COLLINS. Yeah. I mean, common sense would say municipalities are strapped for cash.

Mr. FELDMAN. They are very strapped. Yeah.

Mr. COLLINS. So if that came back you would probably sell more of those.

Mr. FELDMAN. Yes.

Mr. COLLINS. And I think you pointed out the way the laws are written, the solar credits, tax credits really, because of the unique product, do not apply much to what you are doing?

Mr. FELDMAN. Correct. Yes, that is correct. Yeah, unfortunately. Because we are not connected directly to the grid, most of the solar credits go towards if you are putting it on your house, for example, or buildings, which are actually feeding energy back into the electric system and there are credits available for that. In our particular case that does not apply which is a shame.

Mr. COLLINS. Right. Right. Right.

Now, have you looked at any public-private partnerships where somebody would buy these, take the tax credits, if you will, whatever they could get, and lease it back to a municipality?

Mr. FELDMAN. We do offer leasing in what we call a managed service program, but I am not sure if it is exactly what you are asking.

Mr. COLLINS. Now, do a lot of towns start with two or three of these, see how they work, and then expand?

Mr. FELDMAN. Yeah. Typically in a scenario we will try to get 5 to 10. Where the benefit comes in for this particular product is density of deployment. To put one in front of city hall is nice. The mayor can say, yes, we did it, but what we really want is a deployment up and down Main Street or in some very congested area, and we like to get a situation where there are 5 to 10 or so deployed. We can show the benefit. The truck does not have to go there that often. And we can start showing the ROI, if you will, on their investment. And that leads to the further deployments. Yes.

Mr. COLLINS. And do they require much maintenance or are these—

Mr. FELDMAN. There is some maintenance. It has a LED-acid battery in it, just like your car. You need to change the battery. Obviously, they need to be emptied. We recommend cleaning, to be power washed and whatnot, to keep them looking nice so the public will use them. But beyond that they are really built for a 10-year lifecycle.

Mr. COLLINS. Okay. All right.

Well, I am intrigued. It is a great product and I certainly wish you a lot of success.

Mr. FELDMAN. As my time winds down, I have got a perhaps off-topic question for Mr. McCloskey.

On many occasions, my wife has opened the garage door, put the car in reverse, and crashed into somebody parked behind her. Would your braking system prevent that?

Mr. McCLOSKEY. Well, it is a fair question, Congressman. Thank you.

You are seeing that kind of active sensing deployment in almost all automobiles anymore. I think Nissan was one of the first automobile makers to lead the way with it, but you are seeing that as a sensor deployment in the back of all cars so that it will first warn you. And with my wife that might not work either. And so then it will eventually stop the car for you so you would not hit anything. And really where that matters most is not the vehicle behind you but children playing behind you in the street or crossing the driveway as you are backing out. And so it is good technology and it creates more data, which people want to hear about. And there are entrepreneurs out there that would like to play with that data.

Mr. COLLINS. Good. Thank you very much.

Mr. Chairman, I yield back my last five seconds.

Mr. LUETKEMEYER. Thank you, Mr. Collins.

With that, Ranking Member Velázquez.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

Mr. Feldman, your product showcases just how innovation can improve efficiency for cities and businesses. I would appreciate if you could discuss your experience with the regulatory process and how long it took to get your product to the market.

Mr. FELDMAN. Yeah, the regulatory process is cumbersome for a small company, and I think small business entrepreneurs who are trying to get into and produce a wirelessly connected product can really be overwhelmed I think with the amount of not only just the paperwork but certainly the certifications and the testing that needs to go into it. It would really help if there were, when we were starting out, more education or resources, online training re-

sources, something that said, hey, guys. This is what you are in for. And be prepared it is going to cost this much and it is going to take this long. To get technical a little bit, but to build a computer board that is one thin and you need four layers to it instead of one layer. Who knew? And we did not know that going into the whole project. So there are a lot of issues with that.

Ms. VELAZQUEZ. Any thoughts in terms of how the process can be streamlined or better improved?

Mr. FELDMAN. In terms of streamlining it, I would ask for more education, online resources as I said.

Ms. VELAZQUEZ. Mr. West, cybersecurity remains a hot topic these days, as we continue to hear about breach after breach of store security systems, yet small businesses have limited resources and time to give to protecting investment from those attacks. How can we assist these businesses to ensure they have adequate security systems without forcing them to spend excessive resources?

Mr. WEST. A lot of small businesses do not realize that they are at risk because they think they are small, they are operating in a limited geographic area, and so therefore, people would not be of interest. But what businesses have to understand is they sell things, so they have credit card numbers. And so their information is quite valuable and they are at risk. And so there are a variety of things that they should do, some of which do not involve anything to do with government. People need to take their security more seriously. They need more serious passwords. There have been studies suggesting that some of the most common passwords are 12345, things like that. So people need to get much more serious about cybersecurity.

We also think there is a role for government in some areas. For example, in the data breach area. Right now, it is primarily state legislation that handles this, and so there are a wide variety of rules and regulations in place across the 50 states. So Congress might consider a national data breach law just to standardize the requirements and make sure that all companies are operating along a level playing field.

Ms. VELAZQUEZ. Thank you.

Mr. Marshall, while access to broadband has increased in recent years, there is some discrepancy in its availability between geographic areas. Connectivity is becoming vitally important to enabling small businesses to engage in e-commerce and will be closely linked to the future success. What efforts besides relocating spectrum can be taken to expand these services to small businesses?

Mr. MARSHALL. I really do not know how to answer that question.

Ms. VELÁZQUEZ. Anyone—Mr. West?

Mr. WEST. I am not sure exactly what to say. Maybe I would defer to someone else.

Ms. VELAZQUEZ. No? Okay.

Well, Mr. West, the FCC has conducted more than 80 auctions, raising tens of billions of dollars and issuing thousands of new spectrum licenses. What makes the upcoming incentive auction so unique from previous ones?

Mr. WEST. What makes the upcoming auction unique is, one, we have rising demand, and so there is a greater need for this auction

to be successful. And then secondly, we are pinpointing an industry, the broadcast industry that has unused spectrum in trying to create incentives for them to sell to other people. It is a very complicated auction because Congress and the NTIA and the FCC are having to balance a lot of different things. We want money to reduce the national deficit, we want to encourage the repurposing of spectrum to higher priority areas. Congress is setting aside some of the proceeds for the First Responders Network, so it is important to think about how to use that auction to maximize each of those goals. It is important to promote competition so that small firms have an opportunity to bid on the spectrum. So it is very important that this be executed properly.

Ms. VELAZQUEZ. Thank you.

Thank you, Mr. Chairman.

Mr. LUETKEMEYER. Thank you.

With that, it looks like I will ask some questions here.

Mr. Marshall, farming is a completely different business than it was when your dad started out many years ago, and I tell people if you want to jump into the cockpit of a combine, it will look like the cockpit of an airplane anymore with all the dials and all the instruments. It is like quite a panel there. This technology is not cheap. You mentioned a while ago I think it was \$10,000 to fit one of your combines up with something. Is that right?

Mr. MARSHALL. That is correct. For an auto steer system. And that is for an economy auto steer system. I have not purchased one in over a year, but for the one that was more accurate than the current model that I have it was closer to \$20,000 for one tractor.

Mr. LUETKEMEYER. I assume that that makes you money, otherwise, you would not be doing that.

Mr. MARSHALL. That is correct.

Mr. LUETKEMEYER. It makes you that much more efficient that it saves you—well, what is the payback? One year, three years, 10 years?

Mr. MARSHALL. I do not know what the actual payback is. It would depend on the items, too. With something low row clutches or shutoffs for a product application rig, the payback is fairly quick, especially where we farm where it is a lot of small fields that are irregular shaped, having GPS to shut off a boom on an application rig or to shut off the row units on a planter can pay back very quickly. For auto steer, it is not quite as quick, but where we work a lot of hours in the spring and in the fall, the reduction in operator fatigue is worth quite a bit. I spend a fair amount of hours in a tractor in the spring, and having the auto steer there really does help me out over the course of a day.

Mr. LUETKEMEYER. Now, I read an article last night getting ready for today with your Farm Bureau president who made some points with regards to the data that is accumulated by the information and the technology on your combine and on your planter with regards to what is planted, what kind of land you are planting it on, so therefore, you get an idea of what kind of a crop you are going to get in the ground as well as get back out of the ground. And there are some concerns about the ownership of that data. Would you like to expand on that just a little bit?

Mr. MARSHALL. Sure.

Mr. LUETKEMEYER. You mention in your testimony it is a huge issue.

Mr. MARSHALL. Yeah, it is a huge issue that is on the horizon here, coming up a lot quicker than I thought it was going to. And what has changed is that now a lot of that data is being uploaded to the cloud, or if it is not, it will be by next year. I know that there was a project out this fall where they had 1,000 combines running in the field, uploading real-time data. And it is impressive what can be done. I think it has a lot of potential to really do good for the industry. The concern that I have, like I mentioned in my remarks, is who is going to own that data and what is going to be done with it. If you have several combines running across the Midwest at harvest time, uploading data every few seconds, that is very accurate data. You are getting everything from elevation of the field, moisture of the corn, to the yield itself, and if all those combines are uploading to the cloud and someone could access that, it would have a real ability to move a market. If you look at how much time it takes for the USDA to do a survey, and even with them being more efficient than they used to be with advances in technology, it is nowhere near what we could do with this data being uploaded every few seconds to the cloud. And how much value does that have to a trader in Chicago or to someone else that is interested in markets?

Mr. LUETKEMEYER. Can you confine that data to your own database—

Mr. MARSHALL. With everyone that is—

Mr. LUETKEMEYER.—so that you own it yourself and so it is not out there for everybody else to have access to?

Mr. MARSHALL. With everyone that is using online storage now that I am aware of, you can opt out of their collection. And I am concerned about with what might happen going forward. Like I said, this is new. The main purpose is making the Committee aware of it. But this data is going to have a big value to it. It is important not only potentially to markets but to seed companies as well. With the accuracy of that data, effectively what I have done just on my farm is I have set up what they call side-by-side test plots. Seed companies used to pay a lot of money for that. If you take a machinery company that is now collecting data from combines, that data that they have collected from all these farmers now has a very big value to a seed company potentially. It could save them a lot of time.

Mr. LUETKEMEYER. Okay. You brought up a whole lot of issues here. Is the Farm Bureau working on answers to this? Are the individuals, the companies that have access to information, are they working with you trying to find ways to sort of shift through this regulatory ownership of data situation here?

Mr. MARSHALL. Good question. I feel like Farm Bureau has been very active in trying to see what their members feel, and also talking with industry leaders on it. I have been able to talk with some industry officials as well. And again, we are at the beginning of this process. I feel like there has been some good discussion on it. But again, I hope that everyone is aware of how quickly this is progressing along.

Mr. LUETKEMEYER. So even though we have access to gobs and gobs of data, sometimes it causes more problems than it alleviates originally, does it not?

Let me stop there. And we have got a lot of folks who want to ask some questions yet today.

With that, we go to Ms. Chu from California.

Ms. CHU. Thank you.

Mr. Feldman, you have quite a story with BigBelly Solar. I am ranking member in the Access to Capital Subcommittee, and I am very interested to know where BigBelly Solar got funding when it started out and whether those sources have changed over time. Would you share with the Committee how you got financing for your business and what obstacles, if any, did you encounter in the process?

Mr. FELDMAN. Sure. I can reveal a little bit of that.

We are privately funded, and our founder, Jim Poss, who started the company really, mom and dad helped start the business. This was really a couple of guys in a garage, you know, bolting some solar panels and batteries and chains together to work on the product. So that is its inception. Through the years one of our largest distributors, Waste Management, is an investor in the company, but it is still all private money. There is no VC funding at all, nothing of that sort. So it is what we consider private money.

Ms. CHU. Did you encounter any obstacles?

Mr. FELDMAN. While searching for the financing? You know, I cannot answer that. I was not around at the company during that timeframe, so I would not be able to answer that.

Ms. CHU. Okay.

Well, Mr. West, do technology startups face similar to different access to capital challenges compared to brick-and-mortar businesses? And can you expand on policy recommendations for the Committee to improve access to capital for these types of companies or if anything, all small businesses?

Mr. WEST. Startups do face a lot of barriers to getting access to capital, especially over the last few years with the financial crisis, banks and other financial institutions often have been reluctant to take risks. And so oftentimes, in an atmosphere when they are not wanting to take risk, the first people they cut off are startups and small firms. And this is unfortunate because we know that a lot of the innovation, especially in the wireless area, takes place from small firms. You have small app developers who are creating cool education or health-related apps. You have small manufacturing companies that may be designing new products or developing new services. So we think that Congress should continue the path of the Startup Act and try and ease financing for startups. That is going to be a major source of innovation. And so you could think about expanding credits that are targeted specifically on small firms with say under \$5 million in revenue. So it is a highly targeted type of thing. You could also target small firms that are new, meaning firms that have existed for less than five years. So those are a couple ways that Congress might make rules changes that would help startup firms.

Ms. CHU. Mr. McCloskey and Mr. West, while venture capitalists see the mobile app sector as the next big thing, the regulatory

uncertainty has caused hesitancy by these investors, can you elaborate on why these investors are critical to the wireless industry and how continued regulatory delay has hindered its growth?

Mr. McCLOSKEY. Sure. And thank you for the question.

I guess I would start with the level playing field. So a lot of app developers want to give you an easy way to consume a service, whether it is a parking service or a navigation service, some way in your transportation lifestyle to move around. And to do that they need data about the transportation environment, and that data is very hard to come by. It is highly inconsistent from jurisdiction to jurisdiction. The policies in each of the jurisdictions on what is collected, how long it is kept, who has access to it and for how long, is as different as night and day from one jurisdiction to another. And so from an investor perspective they do not have that runway of capital investment that says if I invest here then I can prosecute multiple markets with a single investment. And without that access to data that is really the public's data anyway because it is being collected by a public agency, without some clarity around that there are impediments in the system.

Ms. CHU. Mr. West?

Mr. WEST. So mobile designers and manufacturers do complain about regulatory uncertainty and how that creates problems for them. And I can give examples in the healthcare area because the Food and Drug Administration has just gone through a process to try and ease that uncertainty. There are a wide range of new apps and devices in the healthcare area. You have mobile apps that bring information to consumers to try and help them get more informed about healthcare. You have wearable devices. People exercise and a device will keep track of their number of calories they burn while exercising. And then you have more elaborate devices that physicians and hospitals are starting to deploy that might track someone's sugar levels or vital signs or heart rhythm and electronically transmit that.

And so right now it has been difficult to get certainty in terms of what devices are subject to FDA regulation. So over the last year the FDA has gone through this process. They have put a wide range of devices into one of three categories—either devices that are not going to be subject to FDA regulation, those that definitely are, and then this middle category of enforcement discretion where the FDA indicated it was not likely to regulate unless there was some demonstrable threat or problem that popped up with a specific device.

So I think that is an example of where government can be helpful to private industry just by trying to clarify what the rules are, who is subject to regulation, and under what conditions are they going to be regulated.

Ms. CHU. Thank you. And I yield back.

Mr. LUETKEMEYER. Thank you.

Mr. Chabot?

Mr. CHABOT. Thank you very much, Mr. Chairman.

This morning, INC. Magazine featured an article online listing the eight best startup industries. Almost all of these industries are technology-based, and five of the eight depend on wireless technology and the infrastructure that supports it. So I would like to

thank the chairman for hosting this timely and important discussion. I expect it will not be the last time that this Committee sits down to examine the topic.

My question for the panel is simply how do we as a nation put ourselves in the best position to continue to capitalize on the wireless revolution? I understand there is no magic recipe for success, but in your opinions, what objectives should this Committee and the Federal government set so that every day we are working towards the goal of job creation and supporting small businesses that utilize the technology that we have been discussing to grow our economy. If you just want to go down the line and just take a moment or as much time as you would like, that would be fine.

Mr. Feldman, would you like to start?

Mr. FELDMAN. Sure. I would be happy to.

I think as a nation and as a government, it is probably obvious, not to stranglehold the entrepreneurs. Make them feel like the broadband and the access to the wireless technology should be there and available. Instead of broadband I actually meant bandwidth for the data. A lot of these startup companies, a lot of us are looking at ways of getting video technologies and all the video streaming. This hearing itself is being video streamed across the Internet. And people who are on their cell phone that want to watch this hearing, we need to make sure that there is that bandwidth available to do that.

Mr. CHABOT. I am sure there are millions and millions of people glued to their screens.

Mr. FELDMAN. This is riveting.

But I think in some senses it is a very fine balance in my mind of the government helping and the government staying out of the way. And I am not sure where that line is. I am not qualified to answer that particular question. But there certainly, as we talk about spectrum and how to reuse it, we ourselves are right now a victim of the 2G network that is being shut down in the country by one of the carriers. And that is going to be a financial burden to us as a small company. We have to now go out and visit all of these trashcans and upgrade the internal computer on them to get onto at least the 3G network, not the 4G. And that is a burden. And so anything we can do to help alleviate that I think is a step in a positive direction.

Mr. CHABOT. Thank you.

Mr. Marshall?

Mr. MARSHALL. I do not know how well I can address your question. I will just make a few observations from where I am from.

When I started farming full-time, one of the first things I wanted was good Internet access. And I tried three different satellite Internet companies before I got one that worked respectable. The first one was extremely high maintenance. The second one was moderate improved. And the third one was decent. We do now have fiber in our area, but I am one of few that has access to that fiber out where I live. And it has been a tremendous improvement over the satellite Internet. It does make a big difference for how I run my small business to have good Internet access.

Same thing with cell phone coverage. If I am driving on 36 Highway, which is a four-lane highway, from my house over to St. Joe, several times on that route I lose cell phone coverage. And so all I can perhaps say is that I would encourage you to, of course, have favorable regulation as Mr. Feldman has mentioned, and hopefully not have excess regulation.

Mr. CHABOT. Thank you.

Mr. McCloskey?

Mr. MCCLOSKEY. Thank you for the question, Congressman.

I would add two things. One is you asked about spectrum, and I think everyone on the panel would agree that access to network is important. There are also spectrum allocations today from the FCC for the safety services that the automotive industry is relying on, the 5.9 gigahertz range. And there has been a good bit of talk in the industry about sharing that spectrum. So I would say two things. One is there has been very little technical work on how sharing would really work in practice, and so some good detail work around that to provide clarity would be a good investment of time, but I would also suggest that allowing the safety services to mature, because if we have 30,000 odd deaths on the road here every year and hundreds of thousands worth of injuries, the technology as forecasted by the Department of Transportation to reduce up to 80 percent of the traffic incidents that might be caused by unimpaired drivers. And so to take that incident off the road has tremendous benefits in congestion, which then benefits the entire economy. And so I would encourage us to go slowly in this concept of sharing certain elements of the spectrum that have been allocated for safety.

The second point I would make is that—and I think Mr. Marshall would share my opinion here—is that there should be some clarity around data. Once the data is collected there should be some participatory way where the industry may lead but is encouraged by government in order to provide access to data for businesses that want to grow, while also maintaining anonymity for those who would contribute that data into the study.

Mr. CHABOT. Thank you very much.

Mr. Chairman, I would ask unanimous consent if we have time for Mr. West to answer the question.

Mr. LUETKEMEYER. Absolutely. Go ahead.

Mr. CHABOT. Thank you very much.

Mr. West?

Mr. WEST. Thank you very much.

So at Brookings, we have a Center for Technology Innovation, and we very much support a pro-innovation agenda. And there are three particular points I would emphasize in response to your question. One, the need for infrastructure improvements. The world is going mobile, and so we need faster speeds. We have new innovations in healthcare, energy, transportation, and otherwise that are going online and going through mobile networks. And we are going to need more broadband and faster speeds to take advantage of those.

The last thing I will emphasize is the importance of encouraging more universal access to the Internet. We still have many Americans who are outside the technology revolution, who for various

reasons are not making use of mobile devices and/or accessing the Internet. And so we need to think about digital literacy programs to encourage them to get online and take advantage of the services that are available. Part of it is addressing cost considerations, and also letting them know some of the benefits that would avail to them.

Mr. CHABOT. Thank you very much. My time is expired. I yield back, Mr. Chairman.

Mr. LUETKEMEYER. Thank you.

Mr. PAYNE from New Jersey?

Mr. PAYNE. Thank you, Mr. Chairman.

I would like to thank all of the witnesses today for their testimony.

Just a couple things in general before we start.

Mr. Feldman, I believe, and correct me if I am wrong, but BigBelly has a fairly decent presence in Jersey City, New Jersey?

Mr. FELDMAN. We do. Yes.

Mr. PAYNE. And that was through a federal grant?

Mr. FELDMAN. That was one of the EECB grants; correct.

Mr. PAYNE. Based on prior, I was not sure.

There was quite some pride in my district when they were available, so we thank you for that.

Mr. FELDMAN. Thank you.

Mr. PAYNE. And Mr. Marshall, in terms of the size of your farm, we have just gone through the farm reauthorization and some of these definitions of big farms or small farms. I hear you talk about three tractors. What size is your farm in acreage?

Mr. MARSHALL. We have 4,200 acres of row crop. I would consider us to be a medium-size farm now.

Mr. PAYNE. I want to write that down for next year. Medium.

Mr. MARSHALL. As a youngster, I am from Newark, New Jersey, but my mother was from Dinwiddie County, Virginia, and when people thought I was going for summer retreat, I was actually going to work. I cut tobacco as an 8-year-old and shucked corn and milked cows. And everybody would say, "Oh, how was your vacation?" And I would show them my hands. I just wanted to get an idea based on what you were talking about what size your farm was.

I am also on Homeland Security, and I am very interested in these kinds of technologies that are being discussed. I am the ranking member on Communications and Response, Emergency Preparedness. I introduced a smart grid bill which deals with a study of the electrical grid across the country and seeing steps to make it more resilient and where we need to upgrade in certain areas. And I am glad to say that it was amended and added to the cybersecurity bill that just came out of Homeland Security. So we have seen, and because of that, you know, my experience with natural disasters like Hurricane Sandy, we see how it can devastate our power grid and expose us to cyber-attacks and even harm small businesses.

I would love to hear your thoughts on specific technologies we can use in the face of natural disasters and other devastating events. Mr. West?

Mr. WEST. We actually did a panel at Brookings last summer on natural disasters and the role that technology can play, and we had people from the Red Cross and some academics who studied and so on. And what we learned is that mobile technology increasingly has become part of the way we are dealing with natural disasters. That after they hit, that sometimes cell phones and smartphones are the primary way that people access information. It is the way both organizations like the Red Cross, as well as government organizations get information that allows them to allocate resources so they can get the help to the people who need it in a timely manner. We also discovered that social media networks are becoming a big part of the problem. That people now use social media to communicate all sorts of needs, and during natural disasters, that has become a tremendous source of information. So we have to figure out ways to do the data analytics so that we can mine that information in a very productive way.

Mr. McCLOSKEY. If I could, I would like to add that Japan learned recently after the tsunami and the Fukushima disaster that they could use their version of the safety network that the Department of Transportation announced two weeks ago that it was moving forward with. That is fairly well deployed in Japan at this point. And the challenge with a disaster is that when it occurs, everybody goes to their mobile. They want to call their family. They want to let people know they are okay. They want to check on things. And so the network gets congested. It floods. And what they found in Japan was that with the safety network there is a feature of the technology that allows them to suppress all the other traffic, and then the first responders could use that underlying network as a means of communication for the first responder community. And what I would like to point out by way of that example is that wireless networks are not about one giant network where all the video that you want can be downloaded to it. What you really want are lots of wireless networks of different features because then if something happens to one you have other access avenues in order for the communication to occur.

And so I would encourage you when you think about wireless networks, it is not just the services we get when we sign up for AT&T phones and our Verizon phones, but it is also the myriad ways that communication is occurring out there and we want them all to be available, whether it is a good event or a bad event.

Mr. FELDMAN. If I could add also something in there. Probably not as much a natural disaster but as a result of the Boston Marathon bombings last April, in response to that a little backdrop. The BigBelly is bolted to the street. It does not move. And it has a handle that you open up and deposit your trash in, which is a very safe system because it does prevent large objects from getting in the BigBelly. But there is a concern, of course, with any trashcan at any public event that terrorist actions or just whomever may deposit explosive devices.

In response to that event, we have developed a system on the BigBelly, in fact, where you can lock that BigBelly and be notified wirelessly to the security personnel or the police that there has been a breach of that trashcan. So, in fact, we can say this is closed for the event, and it goes into a special mode, if you will, where

if someone opens that door or attempts to breach that BigBelly, it will notify somebody and they will get it on their cellphone, mobile phone, and back at the command center for immediate response. So that is something that we have tried to use, the wireless for ourselves, in response to some of these events that are happening. You cannot get away from it.

Mr. PAYNE. Thank you, Mr. Chairman.

Mr. LUETKEMEYER. Thank you.

That concludes the first round. We will go with the second round, and I think we have got just a couple folks that want to do that. So if you will indulge us, panel, you are doing a great job.

Ranking Member Ms. Velázquez.

Ms. VELAZQUEZ. Thank you.

Mr. West, the FCC has several options available in designing the upcoming auction, and I would like to ask you, one issue that still needs resolution is whether to make it open or restricted. In terms of small businesses, what do you think is the best option?

Mr. WEST. What we recommend on the auction is a balanced approach in the sense that you need the benefits of both open and closed. We feel that all of the businesses, including the large players, like AT&T and Verizon, have a right to compete and to bid on the auction, but there also is an interest in encouraging small firms to have a fair shot at it. So there are ways to try to balance the needs of large and small firms in this regard. So you can think about putting restrictions on the number of licenses that say the largest companies could bid on, or you could think about a cap in terms of the overall holdings. So that is a way to kind of think about encouraging competition but still allowing the large firms to bid because we are trying to get \$27 billion from this auction, and so you need the large firms there because they have the deep pockets, but we also want to help the small firms and make sure they have a fair right to compete.

Ms. VELAZQUEZ. Any other comments?

Thank you, Mr. Chairman.

Mr. LUETKEMEYER. I think Mr. Payne has one follow-up as well.

Mr. PAYNE. Thank you, Mr. Chairman.

Mr. West, in what ways are these new technologies creating new markets and attracting unlikely entrepreneurs? And how can these technologies benefit or attract entrepreneurs and small business owners from low-income backgrounds?

Mr. WEST. The wireless space is very vibrant and dynamic, so almost by definition it is a great sector in terms of attracting unconventional firms or people who you might not expect to play a role. Because, for example, it does not take a lot of capital or infrastructure or organization to develop a mobile app, but you could develop an app that could be very valuable. We do need to make sure that everybody has a fair chance of playing in this area, and certainly, we want people from diverse backgrounds to be able to access capital, develop products, design things. We think there are long-term things, like putting money into the STEM fields that would encourage women to go into those areas as well as minorities. So there are both kind of short and long-term things that we think would make a difference in that area.

Mr. PAYNE. Anyone else? No?

Thank you, Mr. Chairman. I yield back.

Mr. LUETKEMEYER. Thank you.

I do not have any follow-up questions. Just some observations very quickly.

We are talking today in our Committee hearings about building on the wireless revolution: opportunities and barriers for small firms. I think we have got three great examples here of opportunities that were not available probably 10, 15, 20 years ago, that technology has enabled us to make our lives better from making it more efficient, saving dollars, saving lives. We save lives with some of those things that Mr. McCloskey talked about. So it is a wonderful thing, but each of you have pointed out some problems, things that we have to be careful, whether it is data we have to worry about or potential on the spectrum to make sure we allow small guys to be able to participate. Those are some of the things we have to think about here, and hopefully we will have some thought on this and we can make some suggestions.

But with that I will conclude by saying thank all of you for being here today. You guys did a great job. I appreciate your testimony. It has helped us to better understand the opportunities and barriers of this emerging industry. Your products and all the things that you do hold great promise for economic development and job creation across our country. I look forward to working with my colleagues to ensure that federal policies do not obstruct the continued growth innovation because you are the entrepreneurs. We want more folks here next year, next week, on the same panel telling us lots of great stories about things they are able to do with their products and their inventions and make lives better for all of us.

With that, I ask unanimous consent that members have five legislative days to submit statements and supporting materials for the record.

Without objection, so ordered.

This hearing is now adjourned.

[Whereupon, at 2:16 p.m., the Committee was adjourned.]

A P P E N D I X

Testimony of

Michael Feldman

Vice President of Engineering

BigBelly Solar, Inc.

Committee on Small Business

U.S. House of Representatives

**Building on the Wireless Revolution:
Opportunities and Barriers for Small Firms**

February 11, 2014

Chairman Graves, Ranking Member Velázquez, and Committee Members. I am excited to have this opportunity to share with you how BigBelly Solar uses wireless technology to help curb the usage of our natural resources and help improve our environment.

My name is Michael Feldman and I am the Vice President of Engineering at BigBelly Solar. BigBelly Solar was founded in Newton, MA with the mission of reducing CO2 emissions from gas hungry garbage collection vehicles by eliminating unnecessary miles driven. A standard garbage truck gets 3 miles per gallon and travels an average of 25,000 miles per year. Each truck emits an estimated 100 tons of CO2 per year. In the United States alone, with an estimated 180,000 garbage trucks traveling the roads, they collectively consume over 1 Billion gallons of oil contributing 18 Million Tons of CO2 into the atmosphere each year. That is the equivalent usage of an Exxon Valdez oil spill every 4 days. And this does not include the congestion and nuisance they cause amongst our city streets and roadways. By reducing, or even eliminating, unnecessary driving miles we can significantly cut into the emissions emitted. And this paradigm works even if the vehicles use alternative fuel technologies. As we like to remind people, the cheapest and cleanest mile is the one never driven.

Manufactured in Lexington Kentucky, The BigBelly Waste and Recycling System provides a unique combination of information technology software and on-site compaction at public space locations where citizens deposit their trash and recyclables. By compacting the waste, which increases storage capacity, we are left with a trash can that does not require emptying as often. In fact, the BigBelly compacts at a ratio of up to 5 to 1 which is equivalent to storing five 30 gallon bags of trash into one bag. The BigBelly is capable of holding 5 times more waste and is more intelligent than traditional trash cans. This has been shown to reduce collections on average from twice a day to approximately once every other day. Furthermore, utilizing solar energy to power the compaction mechanics allows a BigBelly to be placed virtually anywhere without the need to connect to the electric grid.

BigBelly has been an early champion and recognized leader in the growing Machine to Machine (M2M) marketplace. This industry is aimed at connecting devices together all around us, and providing useful data for humans to make intelligent decisions. A significant part of the BigBelly solution incorporates wireless technology to transmit data from the trash receptacles to a central database for processing. Users of the system access this data from a simple and easy to use WEB Application that provides important information including which cans need to be emptied, historical reports and analytical reports. There is even a mobile application for smartphones and tablet devices that allow users, such as supervisors and collection personnel, to get up to the minute information about the BigBelly's on their streets. The technology used is very similar to that found in modern cell phones today, only instead of calling another person, the BigBelly calls another machine.

Today, you can find a BigBelly in every state in the US, and over 40 countries around the world. Our product can be seen in cities

and towns both large and small, colleges and universities, military bases, national parks and government agencies. Each BigBelly trash compactor is equipped with a series of electronic sensors, solar panel, a battery, and an internal computer. The solar panel is used to keep the battery charged which drives the compaction mechanisms. A compaction is triggered when the trash level inside the bin crosses a sensor beam. As more waste is deposited, this process continues until the internal computer determines the bin is full. The computer will then use the wireless network to transmit the fullness data to a central computer system, where users can see that the bin requires service. The central system can even be configured to send an e-mail to users for real time updates. We are pioneers in the notion of Smarter Cities—leveraging technologies and information to better manage resources. Trash cans have never been smarter. Example images of our WEB Management Console can be seen on the last pages of this testimony.

Typically, early in the morning, the Waste Operations department will get a report from the central WEB application system that identifies which BigBelly's need to be emptied. These reports are then provided to the truck drivers. In this scenario the trucks only visit those locations that require a collection as opposed to driving up and down every city street, stopping at each waste receptacle. For some of our customers, such as the National Parks, no one needs to be sent to remote areas until it is necessary. The results are measurable and tangible savings in time, fuel and resources.

Efficiency in collection operations vary by customer and usage. After the first year the City of Philadelphia deployed the BigBelly System, they estimated a savings of \$850,000.00 and moved 11 employees to service a new public space recycling program. The program has been a revenue source to the city by diverting trash from costly landfills. Instead, the recyclables are sent to processing centers where the city is paid per ton of material. This fundamental shift has transpired with many of our customers.

Like all small businesses, we are not without our share of challenges. As a member of a unique club of American businesses that are "market makers", those who venture into uncharted territory, we need help and assistance to overcome some of these challenges. As a small privately funded company of 40 employees, our available financial resources are stretched thin placing this technology on the streets and pushing its adoption. For any business wishing to connect wireless devices, there are specific rules and regulations in place by the telecommunications industry requiring costly certification, upwards of \$30,000, before they will allow new devices to connect to their network. While we certainly are in full agreement and have no issue with the intent and protection the carriers require, in many instances, these rules and standards are mostly aimed at cell phones, smartphones and tablet style devices. Not for M2M devices such as the BigBelly. After all, you cannot hold a BigBelly up to your ear!

Similarly, federal assistance for Energy Efficiency Community Block Grants, or EECB grants, has run out. This is most unfortu-

nate as it enabled municipalities to participate in new green products such as BigBelly that have proven rewards not only to the town's balance sheets and budgets, but to the environment as well. Past recipients of EECB grant money used to subsidize the purchase of a BigBelly system include Philadelphia, Albany NY and Jersey City. Your sponsorship, endorsement and legislation assisting environmental and technology products like BigBelly, and creating new or similar program such as the EECB, will benefit all Americans.

There are of course other barriers to adoption. For example, cash strapped cities and towns are unable to apply for and receive Solar Energy credits for the deployment of a BigBelly System. As explained earlier, our use of wireless technology allows the BigBelly product to operate out of the prevue of the electric grid. However Solar Energy grants only apply to products that connect to this grid. Given the positive dollar savings, environmental and economic impact this class of product has, we ask the committee to research and investigate how these solar credits are disbursed and to implement changes that could incorporate new solar technologies like BigBelly that would enable your cities and towns to receive these credits.

And we know firsthand these programs work. For example, the Federal Transit Authority has the ability to assist local Transit Authorities by issuing Formula Grants, or 5307 Grants. Under this program, a BigBelly qualifies as an "amenity" which enables local transit systems to deploy BigBelly's at bus stops or rail stations. Without EECB assistance, the City of Philadelphia would not have the deployment and budget impact they see today. These programs are of significant value to the local communities as well as small businesses like BigBelly. We ask for your assistance in helping to legislate funding for a cleaner environment.

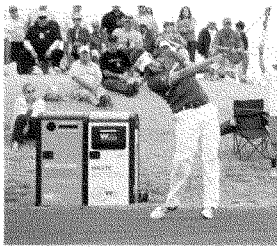
In closing, I would again like to thank the members of the Small Business committee for allowing me this opportunity to present the BigBelly Solar story, and provide insight into how we are using wireless technology to save real budget dollars, resources and most importantly make a tangible impact on the environment.

Respectfully submitted,

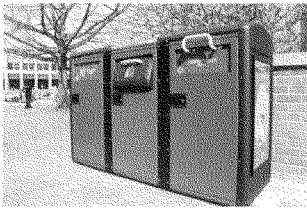
Michael Feldman.



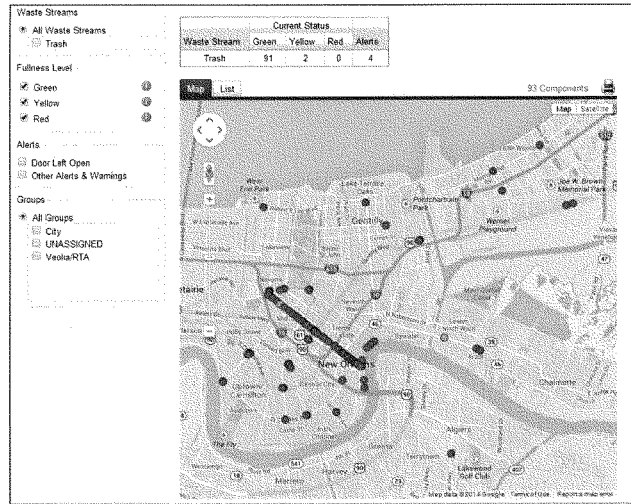
The Times Square area has 88 BigBelly stations.



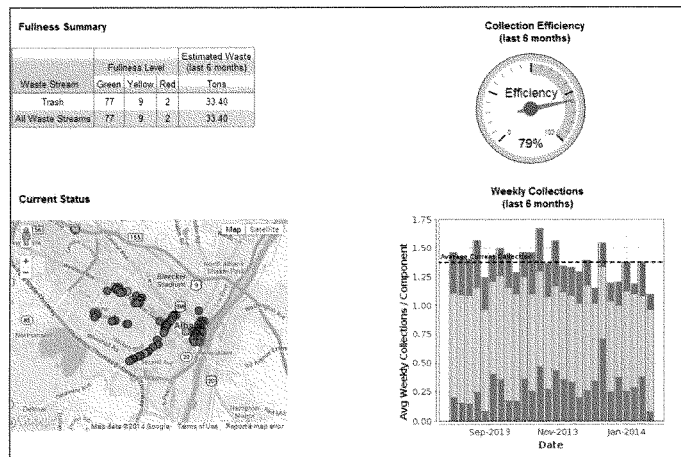
You can find BigBelly's anywhere!



Colleges and Universities promote recycling



Out of all the stations, only the 2 yellow ones need to be collected. (GREEN is okay, YELLOW is full)



A Dashboard using wireless connectivity to show efficiency and collection history



**Statement of the
American Farm Bureau Federation**

**TO THE HOUSE COMMITTEE ON SMALL BUSINESS
RE: TECHNOLOGY IN MODERN AGRICULTURE AND DATA
PRIVACY**

February 11, 2014

**Presented by:
Brian Marshall**

Chairman Graves and Ranking Member Velázquez, Members of the Committee: Thank you for the opportunity to testify on behalf of the American Farm Bureau Federation and the Missouri Farm Bureau Federation. I am here today to discuss how the advancement of technology is affecting modern agriculture.

I own and operate a farm about an hour north of Kansas City in Maysville, Missouri. Both of my grandfathers farmed in the Maysville area as does my father today. In fact, while I am here before you, Dad is fighting the cold and snow to get our farm work done, just like he does every day regardless of the weather. My wife, Kelly, and I farm with my parents, raising waxy corn, soybeans, wheat and cattle. It gives me a sense of pride to be farming the same land that my parents and grandparents did. My wife and I are happy to be raising a little boy who loves everything to do with farming and a little girl who loves everything that's pink.

I am excited to share with you how my father and I are incorporating new technologies into our day-to-day operations. I will also offer perspectives from my fellow Farm Bureau members developed through our organization's recently completed annual policy development process. Our new policies regarding "big data" and unmanned aircraft systems (UAS), as well as our rural infrastructure, are relevant to today's discussion.

After graduating college I worked for a while as a manager for a construction company before returning to the farm when the opportunity to join our family operation arose. While I did not envision being the new "tech guy," that role has become a large part of my responsibility as our farm, and our use of technology, has grown. A couple weeks ago, I spent a day trying to fix a problem I was having downloading data from our combine to my computer. As a young man 20 years ago, that is not how I envisioned working on the farm. While this wave of cutting-edge tech equipment for farming does sometimes have drawbacks, it has ushered in a new world of benefits that outweigh those complications.

I do want to be clear that no matter how advanced a new program or system is, or how accurate a touted device may be today or even years from now, technology cannot take all of the risk out of farming and ranching. Expensive equipment, adverse weather, volatile global markets and changing regulations are simply part of the life we lead.

On our farm we use Global Positioning System (GPS) on several pieces of equipment to handle a multitude of different functions. The application rig we use to apply crop protection products is equipped with auto steer. This feature is not new to agricultural equipment, but is a great help with this particular piece of machinery. Allowing a computer to guide the machine increases accuracy, reduces operator fatigue and allows me to more closely monitor its performance. Our new application rig is also equipped with the AIM Command system, a new method of application that uses pulse width modulation and computer assistance to manage flow and droplet size specific to the product being applied. This ensures a consistent pattern will be maintained at any speed and the chances of offsite application are greatly reduced. It also decreases

operator errors. On our rig the computer turns the tips on and off based on the GPS signal, ensuring the product is applied where needed. This upgrade paid for itself in the first year through reduced input costs.

The most important piece of equipment on our farm is the planter because it is very difficult to fix a poorly planted crop, although Mother Nature gives us a “do over” from time to time. We use a lot of products manufactured by the company Precision Planting. We have added aftermarket parts, such as precision monitor to track everything from seed placement to the amount of force used to put the seed in the ground. In most of our corn fields, we typically plant around 30,000 seeds per acre. If even one of those seeds is planted too close to another, my monitor will alert me, identify in which of the 16 planter rows it occurred and exactly when it happened. I also have an iPad synced to my planter monitor running software that allows me to do real time mapping and data analysis in the field.

When any farmer plants in an irregular shaped field, the potential for over-planting increases. As planters have increased in size, so too has the potential for overplanting. To reduce this potential, we equipped our planter with point row clutches. The point row clutches rely on a GPS signal to shut them off whenever crossing into any part of the field that has already been planted. Not only does this save seed cost, but it helps eliminate yield loss from plant overcrowding in double planted areas.

Three of my tractors are equipped with auto steer. At \$10,000 per machine for an economy system, it is not cheap to put auto steer on a tractor. All of the technology we have discussed did require a sizable investment. But we have determined that the benefits outweighed the costs. We feel that the reduction in inputs as well as operator fatigue alone pays for these investments. The same may not be true for our neighbor down the road and certainly not for every farm or ranch.

For years, farmers have used technology advances to better match varieties of seeds, production inputs and management practices with specific field characteristics. Additionally, many farmers have had the ability to map yields with a GPS receiver. While farmers have been experimenting with this technology for well over a decade, only now is the industry starting to consider all the use of this transformative technology.

Agribusiness firms are offering and designing “prescription” type services for farmers, enabling them to apply seed and fertilizer in varying amounts across their fields using the technology I described earlier. Just recently, Dad and I met with an agronomist to discuss prescriptions for our farm. Many farms across the Midwest have soil types and yield potential that vary widely; our land is no different. With the technology available today, we can merge 10 years’ worth of data to get a more complete picture from which to make management decisions.

We have maps generated by our planter, yield maps from our combine, and advanced Light Detection and Ranging (LIDAR) soil maps that we can now combine to generate useful prescriptions for

maximizing yield and reducing inputs. If a yield map shows a soil type with a lower yield potential, the prescription can then call for a lower seeding rate and less fertilizer in that management zone. Similarly, if the LIDAR elevation map shows the lower ground is more productive, we can increase the plant population in those zones.

It is the combination of these different maps that is leading to new breakthroughs. Mini weather stations and weather services with field specific data will only help to improve the accuracy of prescriptions as we go forward. The ability to overlay data from our planters with data from our combine is a very recent development. This one advancement has given us a wealth of farm specific information that can now be generated in the combine. Ten years ago it took careful planning and a support team with specific in-field scales to tediously test a few acres and generate only a fraction of the data we can have instantly in our combines today. This will lead to increased yield as farmers and agronomists now have better tools for selecting the corn and soybean varieties best suited for each individual farm.

This use of an individual farmer's data to design a different program for each acre in a field that may span 200 or more acres will augment the farmers' years of experience with satellites and algorithms. The new technology undoubtedly will help make farmers more efficient and allow the use of fewer inputs while increasing their overall level of outputs and profitability. While companies have collected and analyzed agronomic, yield and other farm level data for some time, the amount of real-time information gained at a micro-level unit is a big change that has largely taken place within the last two years and is of concern to our organization.

Several agricultural equipment firms have introduced technology whereby the data from combines is uploaded every few seconds to the Cloud. If a large agribusiness firm had access to real-time information from 1,000 or more combines randomly spread across the Corn Belt, that information would be extremely valuable to traders dealing in agricultural futures. Traders have traditionally relied on private surveys and U.S. Department of Agriculture (USDA) yield data. These yield estimates are neither timely nor necessarily accurate. But now, real-time yield data is available to whoever controls those databases. Virtually every company says it will never share, sell or use the data in a market-distorting way—but we would rather verify than trust.

From Farm Bureau's perspective, one of the most important issues related to "big data" goes directly to property rights and "who owns and controls the data" (Attachment 1). The risks to privacy that the farmer faces, such as his pesticide or GMO usage that may be an accepted practice but politically unpopular, are of great concern.

In addition, a farmer's information is valuable to the companies, so farmers should have a say in and be compensated when their data is sold. Farmers need to protect their data and make sure they bargain wisely as they share their data with suppliers and companies who desire access to their information.

Farmers are rightly concerned about data privacy. Even if an individual operator does everything to the best of his ability, following all the applicable rules, regulations, and best management practices, there is still concern that the Environmental Protection Agency (EPA) or one of the numerous environmental organizations that plague agriculture might gain access to individual farm data through subpoenas or an overall-clad Edward Snowden type.

Related to this issue, Farm Bureau supports the use of unmanned aircraft systems (UASs) for commercial purposes including agriculture, forestry, and other natural resources uses (Attachment 2). As the law stands now, if I wanted to hire someone to scout my crops with a UAS, they would be subject to the same FAA regulations as a commercial jet. Requiring a UAS to have a tail number may be a bit excessive in my personal opinion.

Our organization believes the operator of an UAS should be required to gain the consent of the landowner and or farmer if the UAS will be surveying or gathering data about the landowner's property below navigable airspace. We oppose a federal agency using UASs for the purpose of regulatory enforcement, litigation,, and as a sole source for natural resource inventories used in planning efforts or surveying and gathering data without the consent of the landowner and or operator below navigable airspace.

The future is truly exciting in terms of technological advancement in agriculture, but we should not overlook the gaps that exist, particularly in rural areas.

High-speed broadband services have great potential for expanding business, healthcare, and education opportunities in our communities. According to the Federal Communications Commission's (FCC) Broadband Statistics Report,¹ the broadband availability gap between urban and rural areas nationwide is narrowing (100 percent available in urban areas versus 94.2 percent available in rural areas). In 2012 my county, DeKalb, ranked 87th out of 114 counties (plus St. Louis City) in terms of broadband speed greater than 25 Mbps and 2834th out of 3234 U.S. counties and territories.²

Until last fall, we had tried three different satellite Internet providers. The last one was fair at times, but the first two were awful—high maintenance, high cost and low speed. We now have high speed internet through our rural electric cooperative's fiber-to-the-home network, a project made possible through federal loans and grants. The added competition in our area helped us find an Internet package that better fits are needs.

The switch from analog to all-digital television in 2009 is another issue that continues to impact rural residents. On its website, the FCC describes Digital Television (DTV) as an "advanced broadcasting technology that has transformed the television viewing experience." I believe that most people in my hometown would agree that their TV viewing experience certainly changed, but not for the better. Even with a digital converter box and an antenna, only one

¹ <http://www.broadbandmap.gov/download/reports/national-broadband-map-broadband-availability-in-rural-vs-urban-areas.pdf>

² www.broadbandmap.gov/rank

broadcast station in St. Joseph has a signal strength rated as “moderate.” St. Joseph is about 40 miles from our farm. No stations in Kansas City, about 70 miles southwest of Maysville, have signal strength above “weak.” (Attachment 3).

This is the reason farmer and rancher voting delegates at the Missouri and American Farm Bureau Federation annual conventions adopted policy urging the FCC to examine ongoing problems resulting from the analog to digital conversion and work with broadcast stations to ensure the continued availability of free local programming.

Cell phone reception continues to be a problem in rural areas even though wireless companies have made strides in expanding service. I frequently travel 36 Highway, a four-lane road that runs east to west in northern Missouri, and always lose reception and drop calls even though I have service with a large carrier and multiple companies have towers along 36. Our organization supports the FCC working with cell phone companies to increase interoperability among towers.

I find it ironic that I can upload yield data in real-time from my combine to the Cloud as I am picking corn yet it is difficult to watch local programs on my television or have a cell phone conversation in certain spots in my area. I hope the committee will share these concerns with the FCC since they affect farmers and other small business owners in rural areas.

As I have learned by attending county Farm Bureau board meetings and young farmer conferences, what works on my farm may not necessarily be feasible for my neighbor. America’s farms and ranches vary in size and scope, and farmers need a variety of tools in the toolbox. I do not expect you to share my level of enthusiasm for pulse with modulation or point row clutches, but I hope you are excited about farmers’ use of technology to increase efficiencies, better manage inputs such as fertilizer and ultimately help us better serve consumers from my hometown to Brooklyn, New York.

Attachment 1: American Farm Bureau Federation (AFBF) proprietary data policies as adopted by voting delegates at the 95th Annual Meeting held January 2014.

1. Proprietary data collected from farming and agricultural operations is valuable, should remain the property of the farmer, and warrants protection.

2. We support:

2.1. Efforts to better educate farmers and ranchers regarding new technology or equipment that may receive, record, and/or transmit their farming and production data;

2.2. Requiring companies that are collecting, storing, and analyzing proprietary data to provide full disclosure of their intended use of the data;

2.3. Formation of standardized protocols regarding privacy and terms of conditions to ensure a standard definition of all components within the contract. We should be an active participant in developing these protocols;

2.4. Compensation to farmers whose proprietary data is shared with third parties that offer products, services or analyses benefiting from that data;

2.5. Multiple participation options being included in all contracts;

2.6. All proprietary information between the farmer and the company remaining between the two entities. This would not preclude a farmer from sharing data with whomever he/she chooses (e.g., a consultant);

2.7. Utilizing all safeguards to ensure proprietary data is stored at an entity that is not subject to a Freedom of Information Act (FOIA) request;

2.8. The farmers' right to enter into agreement and their rights to sell their proprietary data to another producer (e.g., in land sale);

2.9. Private companies entering into agreements which would allow for the compatibility/updating of equipment and updating of software;

2.10. The right of a farmer to have access to their own data, regardless of when it was shared with a company; and

2.11. The right of the producer who no longer wishes to participate in aggregated data sharing with a private company, to remove their past aggregated data from the company's database and revoke that company's ability to sell or use that data in the future.

3. We oppose any federal agency or FOIA-eligible entity from serving as a data clearinghouse for all proprietary data or aggregated data collected by private companies.

Attachment 2: American Farm Bureau Federation (AFBF) unmanned aircraft systems (UAS) policies as adopted by voting delegates at the 95th Annual Meeting held January 2014.

1. We support:

1.1. The use of unmanned aircraft systems (UASs) for commercial purposes (i.e., agriculture, forestry, and other natural resource use);

1.2. Requiring the operator of the UAS to gain the consent of the landowner and or operator, if the UAS will be surveying or gathering data about the landowner's property below navigable airspace; and

1.3. The regulation of UASs as recreational aircraft.

2. We oppose:

2.1. A federal agency using UASs for the purpose of regulatory enforcement, litigation and as a sole source for natural resource inventories used in planning efforts;

2.2. UASs surveying and gathering data without the consent of the landowner and or operator below navigable airspace; and

2.3. FAA regulations of UASs as fixed-winged aircraft.

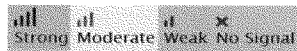
Attachment 3: <http://transition.fcc.gov/mb/engineering/dtvmaps/>

DTV Reception Maps

Use this program to check for the DTV signals that are available at your location. For more information on antennas, see the Antenna Guide.

Signal strength calculations are based on the traditional TV reception model assuming an outdoor antenna 30 feet above ground level. Indoor reception may vary significantly.

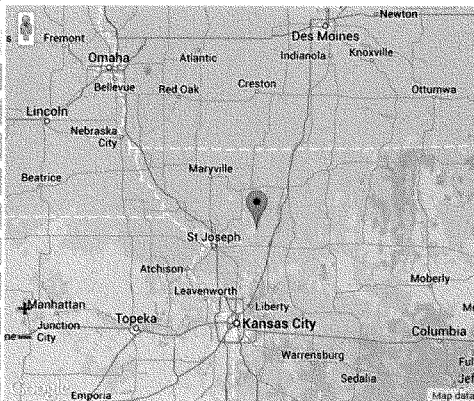
Signal Legends



Callsign	Network	Virtual Channel	Band
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Click on callsign for detail

	KQTV ABC	2-1	Hi-V
	KCPT PBS	19-1	UHF
	KCTV CBS	5-1	UHF
	KMBC ABC	9-1	UHF
	KSMO MYTV	62-1	UHF
	KCWE CW	29-1	UHF
	WDAF FOX	4-1	UHF
	KTAJ TBN	16-1	UHF
	KPXE ION	50-1	UHF
	KMCI IND	38-1	UHF
	KSHB NBC	41-1	UHF





Testimony of

Leo McCloskey

Senior Vice President, Technical Programs

Intelligent Transportation Society of America (ITS America)

House Committee on Small Business

Hearing on

Building on the Wireless Revolution: Opportunities and Barriers for Small Firms

Tuesday, February 11, 2014

Chairman Graves, Ranking Member Velázquez, and members of the Committee, thank you for inviting me to testify about the rapid growth in innovative wireless technologies and services being developed and commercialized by small businesses in the transportation industry.

The Intelligent Transportation Society of America (ITS America) is the nation's largest association bringing together the transportation, technology and research communities to advance solutions to our nation's infrastructure, safety and mobility challenges. About half of our nearly 500 members are public agencies, universities and research labs. The other half are private sector companies, from the major automakers, high-tech, telecom, tolling and infrastructure firms to small businesses, start-ups and entrepreneurs who are increasingly taking the transportation world by storm.

Intelligent Transportation Systems (ITS) encompass a broad range of information and communications technologies that improve transportation safety, efficiency, convenience and system performance. When integrated into the nation's roadways, vehicles, and public transit networks, ITS can help reduce congestion, improve mobility, save lives and optimize existing infrastructure. Examples of ITS include advanced traffic, freight, and incident management systems; synchronized and adaptive traffic signals; electronic tolling and payment systems; real-time traffic, transit, routing and parking information; collision avoidance and response technologies; high-occupancy toll (HOT) lanes; dynamic carsharing and ridesharing; infrastructure condition assessment technologies; and other high-tech solutions tailored to local or regional challenges.

ITS and Small Business

It is widely accepted that a transportation system which enables the efficient movement of goods and people is necessary for economic growth. Inventory deliveries, shipments to customers and a

ready workforce all benefit from a predictable and free-flowing transportation system.

ITS builds upon these efficiencies using real-time traffic data to reduce congestion via integrated corridor management, real-time incident and emergency response systems, traveler information systems, traffic signal optimization, electronic truck inspections, and even simple things like ramp meters. In addition, this same real-time data is being used by private sector innovators to give today's commuters better information about current traffic conditions, more efficient routing alternatives, public transportation options and even available car and truck parking spaces.

Researchers from the Information Technology and Innovation Foundation (ITIF) and the London School of Economics have found that investing in ITS creates a network effect throughout the economy and stimulates job creation across multiple sectors, including the high-tech, automotive, information technology, consumer electronics, and related industries of which a large proportion are small businesses. In addition, an average of 50 percent of ITS project spending goes directly to wages and salaries according to U.S. DOT, as compared with 20 percent for new highway construction. Moreover, according to ITIF, the use of ITS technologies on average provides an estimated 9-to-1 benefit-cost ratio as compared to an estimated 2.7-to-1 benefit-cost ratio for the addition of conventional highway capacity.

You may have seen the U.S. Department of Transportation's recent announcement about the advancement of vehicle-to-vehicle communications technology, which is expected to prevent or reduce the impact of 80 percent of unimpaired crash scenarios. While a reduction in automobile crashes may not appear to be a job creation activity, mitigating congestion and improving throughput on our nation's transportation system is a foundation for a strong economy on which businesses of all sizes can better plan for growth.

Historically, the auto industry has focused much of its safety efforts on mitigating the impacts of a crash after it happens; but the next giant leap in reducing the number of fatalities and injuries on our nation's roads is to prevent crashes before they happen. This has a direct impact on congestion on our roadways. According to the Texas A&M Transportation Institute's latest Urban Mobility Report, the financial cost of congestion is more than \$120 billion each year, wasting nearly 5.5 billion hours and \$3 billion gallons of gasoline, causing the average commuter to spend almost a full work week stuck in traffic, and putting more than 56 billion additional pounds of emissions into our communities, towns and cities.

Connected vehicle technologies would not be here today without the innovation of small businesses and entrepreneurs who were willing to take a risk in order to provide the public with better products and services. While U.S. DOT and the automakers have received much of the coverage for these technological advancements, it would not be happening without small businesses like Santa Clara, California-based Savari Networks serving as the leading supplier of on board and road side units for the connected vehicle market in the United States. While still a small company,

Savari just opened an R&D center in Detroit and expects to double its employee strength by end of the year. And they are one of many small businesses who are working to transform our transportation future.

Other companies are working to integrate transportation services based on connected vehicle technology into smart phones and other aftermarket devices so these groundbreaking safety benefits can be extended all throughout the nation's infrastructure as well as to pedestrians, motorcyclists and bicyclists. This promises to significantly reduce the number of deaths and injuries on our nation's roads while unleashing a new wave of innovation, from advanced traffic management systems and on-demand services to real-time traffic, transit and parking information and countless new transportation applications that we haven't even thought of yet.

Even before we reach a fully-deployed connected vehicle network, the explosion of real-time transportation information, location data, wireless billing and smart phone platforms have transformed mobility, providing commuters with a plethora of new options from car-sharing, ride-sharing and on-demand services to smart parking and navigation apps. Small businesses like Uber, Lyft, WAZE, RideScout, Car2Go, Streetline, ParkMobile, Parkopedia, Getaround, and many other companies which didn't exist five years ago are fast becoming household names, using wireless technology and transportation data to provide more efficient and convenient services to the public.

These small businesses are creating good jobs, thousands of jobs, with technologies that enable smarter use of the nation's transportation system and services.

Removing Barriers for Small Business

Today's market is enchanted by driverless vehicles, which is creating even greater excitement around the ITS industry. However, autonomous and connected transportation produces incredible amounts of data which needs to be collected, analyzed, secured and in some cases made available. While this provides tremendous opportunity for innovation, our future transportation network is challenged by a patchwork of data policies that undermines connectivity and creates an uncertain environment for entrepreneurs.

Absent leadership and clear policy direction from Congress and governmental agencies, businesses that could provide valuable services in the market and generate jobs are unable to find firm footing. And our awareness of transportation system performance is much worse because of inconsistent or incomplete policies from the hundreds of agencies that operate the nation's transportation network. A common policy that makes transportation data available and secure, while maintaining complete anonymity for individual and commercial users, is both possible and necessary.

Another challenge is the need to preserve dedicated spectrum in the 5.9 GHz band which was set aside by the Federal Communica-

tions Commission (FCC) to ensure high-speed, accurate, secure and reliable communications which are critical for connected vehicle safety systems. It is essential that the availability and performance of this spectrum is protected for safety purposes, while also freeing up additional spectrum where it makes sense and where it can be done without jeopardizing safety for expanded WiFi applications.

These innovations described here will be showcased from September 7–11, 2014 at the 21st World Congress on Intelligent Transportation Systems which will be held in the birthplace of America's auto industry in Detroit, Michigan. I invite each of you to visit Detroit and ride in a connected or automated vehicle or check out the latest transportation innovations on display. You will learn firsthand how dedicated men and women from innovative businesses large and small are working to improve our nation's transportation system and provide new services while creating good jobs and strengthening our nation's economic future.

I thank you for the opportunity to testify, and look forward to answering your questions.



U.S. House Committee on Small Business

February 11, 2014

Statement of Darrell M. West, Ph.D.

Vice President and Director of Governance Studies,
and Director, Center for Technology Innovation, Brookings Institution

Chairman Graves, Ranking Member Velazquez, and members of the Committee. Thank you for the opportunity to testify at this hearing on “Building on the Wireless Revolution: Opportunities and Barriers for Small Firms.”

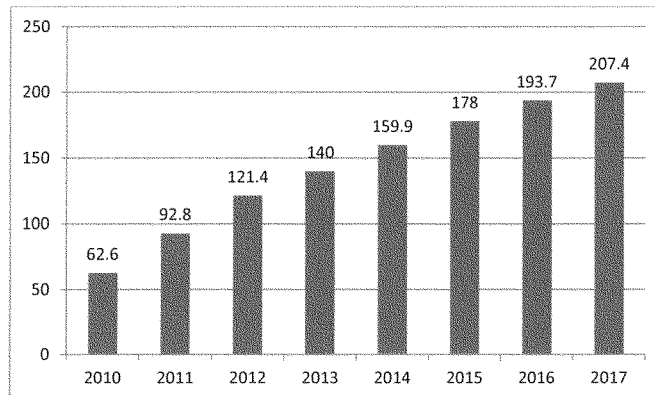
Since 2008, I have been Vice President and Director of Governance Studies at the Brookings Institution. I am the author of 18 books, including *Digital Government: Technology and Public Sector Performance* (Princeton University Press, 2005), *Digital Medicine: Health Care in the Internet Era* (Brookings Institution Press, 2009) and *Digital Schools: How Technology Can Transform Education* (Brookings Institution Press, 2012). I direct the Brookings Center for Technology Innovation.

As the statement below demonstrates, wireless communications is growing dramatically and is vital for economic development. There are tremendous opportunities for small businesses if we can overcome the obstacles that currently exist. We need a balanced spectrum policy that includes licensed and unlicensed spectrum, greater efficiency in the use of current spectrum, incentive auctions that reallocate underutilized bandwidths to high priority areas, and universal access to high-speed broadband.

The Growth of Mobile Technology

Mobile usage is rising rapidly in the United States. According to an eMarketer Statista analysis, the number of U.S. smartphone users has risen dramatically since 2010. The total increased from 62.6 million in 2010 to 140 million in 2013 (see Figure 1). By 2017, it is likely to rise to 207.4 million smartphone users.¹

Figure 1 Number of U.S. Smartphone Users in Millions



Source: eMarketer Statista report, “Number of Smartphone Users in the U.S. from 2010-2017”, with link at <http://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-us/>

The Role of Mobile Technology in Economic Development, Education, and Health Care

Mobile technology is an important driver of job creation and economic growth. An analysis by economists Harald Gruber and Pantelis Koutroumpis, for example, found that national growth improves significantly based on mobile usage. Looking at 192 nations

from 1990 to 2007, they found increasing returns in terms of productivity and growth linked to the use of mobile devices. For high income nations, mobile technology added 0.20 percent annually to Gross Domestic Product, while in low income countries, it contributed 0.11 percent.² They also looked at mobile infrastructure investment and found that it paid off in economic growth. Nations that invested saw annual GDP gains of 0.39 percent in high income places and 0.19 percent among low income places.³

A Deloitte analysis of the United States meanwhile “estimated \$25–53 billion investment in 4G mobile wireless technology in the US is projected, using standard GDP multipliers for the industry, to create \$73–151 billion in GDP growth and between 371,000 and 771,000 new jobs.”⁴ This and other studies around the world corroborate the contention that investment in mobile broadband enhances economic growth.

With new advances in mobile learning and mobile health care, it is crucial to have high-speed networks that promote connectivity and communications. In the education area, for example, wired classrooms, handheld devices, and electronic instruction let pupils learn at their own pace. Personalization makes education more adaptive and timely from the student standpoint and increases the odds of pupil engagement and mastery of important concepts.⁵

We are seeing the growing use of wireless devices in health care. Medical treatment now draws upon remote monitoring devices, electronic medical records, social networking sites, video conferencing, and Internet-based recordkeeping systems. Using remote monitoring devices, people can measure their own weight, blood pressure, pulse, and sugar levels, and send test results electronically to health care providers. They can get personalized feedback via email and reminders when they gain weight, have an uptick in their cholesterol levels, don’t take their medicine, or have high blood pressure.⁶

Around 80 percent of American doctors use a mobile device in their medical practice. According to research by Andrea Downing Peck, doctors rely upon their smart phones to “search for drug and treatment reference materials, learn about new research, diagnose diseases, and educate patients.” Ready access to information makes them more efficient and effective in their operations.⁷

Research by the Boston Consulting Group and Telenor Group found that “mHealth can reduce the costs of medical care among the elderly by 25 percent [and] double access to physicians by those living in rural areas.”⁸ According to those researchers, it has made a huge difference in medical service delivery and helped to bring health care to underserved areas.

Current Barriers

Mobile technology is vital for small businesses because it helps entrepreneurs launch companies, build businesses, and provide jobs. Wireless broadband allows them to stay connected even while they are on the go. They can reach bank officers, suppliers, and customers as they travel around the area. This helps them remain

in close contact with key people and build the required personal relationships.⁹

But there are a number of obstacles that make it difficult for small businesses to take advantage of the mobile revolution. These problems include financing, regulation, spectrum availability, infrastructure, and access. Below, I review these challenges in greater detail.

Financing

It is hard for small businesses to attract sufficient financial capital. The Startup Act addressed some of these issues through an easing of paperwork requirements and regulatory oversight. But in the aftermath of the Great Recession, large financial institutions often don't want to lend money to new businesses. They worry about lending risk, business models, and long-term sustainability. These fears make them reluctant to take risks with emerging companies, and this creates obstacles in terms of new firms getting off the ground.

Regulation

It is a struggle for many small firms to deal with government regulations. They don't have large staffs to process the required paperwork and make sure they are compliant with federal rules. Mobile industry companies have to deal with a large number of agencies, such as the Federal Communications Commission, which regulates telecommunications, the Securities and Exchange Commission, which oversees finance and business operations, the Federal Trade Commission, which examines market competition issues, and the Food and Drug Administration, which regulates medical devices. Facing detailed record-keeping and oversight, it often is difficult for small firms to gain a foothold in the industry.

Spectrum

Spectrum policy has significant implications for small businesses. If one looks at spectrum policy, it historically has been allocated on a band-by-band basis for particular services. That means that certain frequencies have been reserved for aviation, television broadcasting, paging services, medical devices, cellular, and the like.¹⁰ Overtime, a hodge-podge of decisions has led to inefficiencies. Rapidly-growing areas are running out of available spectrum, while others experience demand that is far below the available spectrum capacity.

As shown in Figure 1, demand has risen tremendously in the wireless area and is out-stripping the available supply. According to the FCC, we need a minimum of 300 MHz for mobile technology over the next five years in order to accommodate growing cellphone usage, handheld devices, smartphones, tablets, and mobile broadband.¹¹ It is vital to gain access to spectrum in order to facilitate job creation, economic development, and long-term innovation.

Infrastructure and Access

There are issues for small business in regard to mobile infrastructure. Firms require high-speed networks that connect them with consumers and businesses. Right now, we need faster networks with more universal connectivity. Based on Pew Research Center polls, around 30 percent of Americans do not have home Internet access.¹² There are many reasons why people have not adopted broadband service. A survey undertaken by the Federal Communications Commission, for example, reveals that 36 percent cite the overall cost of the service, 22 percent say they are uncomfortable with the Internet, and 19 percent find digital content not compelling enough to warrant usage.¹³

Needed Policy Actions

Broadband utilization and mobile technology innovation are growing rapidly, but there remain several actions that would further business opportunities and long-term economic development. Below, I review specific actions that will help small businesses take advantage of wireless technology.¹⁴

Access to Financial Capital

In order to help small firms get off the ground, we must make it easier for them to attract financial capital. One reform that would be helpful in this regard is a research credit for new firms that earn less than \$5 million. This investment would bolster capital acquisition and help these companies bring innovative products or services to the marketplace. Small investments of targeted tax credits can yield significant economic benefits.

More Flexible Rules

We need to think about more flexible rules in regard to the mobile sector. There is tremendous vibrancy and dynamism in this sector and federal agencies should be careful that they encourage innovation at the same time they protect the health and well-being of consumers. The Food and Drug Administration, for example, took useful steps in this regard through its 2013 guidance on mobile medical devices.¹⁵ It reviewed a variety of apps and products, and outlined which ones should be subject to regulation, which ones should not, and which ones would be subject to “enforcement discretion”, meaning that they are not likely to pose significant risks to consumers. This kind of thoughtful oversight helps medical app and device manufacturers plan for the future and understand what regulatory environment they are likely to face in the future.

Incentive Auctions to Reallocate Scarce Spectrum

One of our big challenges is the mismatch between spectrum supply and demand in particular bandwidths. A market-based mechanism for reallocating scarce resources is spectrum auctions.¹⁶ Used successfully in the past, members of Congress should allow companies that no longer need spectrum to sell them to other business willing to pay.

This approach would have several benefits. It would provide a way for companies to sell unused resources. It gives access to spectrum for cell and mobile providers so they better can serve consumers and businesses. Auctions also bring in needed resources to the federal government to finance the national budget.

The Federal Communications Commission currently is working on its specifications for an upcoming auction. Legislators should make sure that small businesses have a fair shot at competing for unused spectrum and that entrepreneurs from diverse walks of life have an opportunity to bid on spectrum.

Fees for Unused Spectrum

A number of public or private organizations has unused spectrum. This includes the military forces, broadcast television, and government agencies. They sit on spectrum thinking that someday they may use it. Rather than not making use of a valuable resource, they should pay fees for holding that spectrum. Having fees for unused spectrum would provide clearer incentives for organizations to employ the spectrum or understand the value to others if they don't make use of it. It is a way to bring market valuations into the spectrum rights engine.

Unlicensed Applications in the 5 GHz bandwidth

A number of innovative small business services make use of unlicensed Wi-Fi. Consumers can access a wide range of digital services at coffee shops, in airports, and through business establishments around the country. According to the Cisco Visual Networking Index, 55 percent of all Internet Protocol traffic will run over Wi-Fi networks by 2017.¹⁷ A number of Internet service providers are moving their service delivery to Wi-Fi hotspots. These are provided either by consumers themselves or made available through phone carriers. Improving availability to unlicensed spectrum through the 5 GHz band will alleviate some of the current congestion. However, next-generation Wi-Fi (so-called Gigabit Wi-Fi) will need unlicensed spectrum in the 5 GHz band.

Better Use of 3.5 GHz Bandwidth

There currently is under-utilized bandwidth in the 3.5 GHz area. It is possible to turn this low-power segment into a Citizens Broadband Service.¹⁸ Right now, it is deployed for naval radar utilization, but could be used for civilian purposes in geographic areas where the Navy does not operate. This spectrum repurposing would allow people to take advantage of these networks.

More Efficient Use of Existing Spectrum

We need to determine ways to make more efficient use of existing spectrum. Advances in cognitive radio applications help to make more efficient use of current resources. Scientists are working on ways that allow multiple, non-interfering uses of various bandwidths. This is helping to create greater efficiency in the spectrum rights system.

In a Brookings paper, Robert Matheson and Adele Morris propose technical solutions designed to improve the efficiency of spectrum utilization. They argue that it is possible to improve bandwidth utilization through a series of technical improvements. For example, they suggest that licensees should be able to “buy, sell, aggregate, and subdivide their LERs (licensed electrospace right) at will.”¹⁹ A “flexible rights regime” offers greater efficiency, they say, than the current “command and control” approach.

Infrastructure Improvements

New applications in education, health care, high-definition television, and video conferencing require high-speed mobile broadband. We need to improve data-sharing networks and promote wireless connections that take advantage of these new developments. Although nearly all of the investment for infrastructure improvement will come from the private sector, the FCC should make sure its rules facilitate innovation.

We need to encourage local communities to streamline the approval process for building new cell towers and laying fiber optic lines. Right now, communities have different rules and processes and this makes it expensive for private companies to expand digital infrastructure in a timely and affordable manner.²⁰

Higher Home Broadband Adoption Among Underserved Populations

For underserved populations, there are a variety of actions that would increase home broadband adoption. For example, digital literacy programs would train people on online applications that may be useful to them. Improved market competition also would help drive down consumer cost barriers that currently limit use. And outreach programs could help bridge the digital divide based on age, race, gender, income, and education. With these proposed actions, consumers and small businesses would have better opportunities to gain the benefits of the mobile economy.

Notes

¹eMarketer Statista report, “Number of Smartphone Users in the U.S. from 2010–2017”, see link at <http://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-us/>.

²Harald Gruber and Pantelis Koutroumpis, “Mobile Telecommunications and the Impact on Economic Development.” *Economic Policy*, Volume 67, July 2011, pp. 387–26.

³Harald Gruber, and Pantelis Koutroumpis, “Mobile Telecommunications and the Impact on Economic Development.” *Economic Policy* Volume 67, July 2011, pp. 387–426.

⁴Deloitte, “The Impact of 4G technology on commercial interactions, economic growth, and U.S. competitiveness”, August 2011. http://www.deloitte.com/assets/DcomUnitedStates/Local%20Assets/Documents/TMT_us_tmt/us_tmt_impactof4g_081911.pdf.

⁵Ruth Moody and Michael Bobic, “Teaching the Net Generation without Leaving the Rest of Us Behind: How Technology in the Classroom Influences Student Composition”, *Politics & Policy*, Volume 39, no. 2, 2011, pp. 169–194.

⁶Darrell M. West, “Improving Health Care through Mobile Medical Devices and Sensors,” Brookings Institution Center for Technology Innovation, October, 2013.

⁷Andrea Downing Peck, “App-solutely fabulous”, *Medical Economics*, suppl, Nov. 25, 2011, pp. S11–S14.

⁸Boston Consulting Group and Telenor Group, “Socio-Economic Impact of mHealth”, February 28, 2012.

⁹Darrell M. West, Allan Friedman, and Walter Valdivia, “Smart Policy: Building an Innovation-Based Economy”, Washington, D.C.: Brookings Institution Center for Technology Innovation, 2013.

¹⁰See the Federal Communications Commission’s “Spectrum Dashboard” at <http://reboot.fcc.gov/spectrumdashboard>.

¹¹Federal Communications Commission, *Connecting America: National Broadband Plan*, 2010, p. 75.

¹²Pew Research Center, “Home Internet Access,” May, 2013.

¹³Federal Communications Commission, *Connecting America: National Broadband Plan*, 2010, p. 168.

¹⁴Additional proposals can be found at Darrell M. West, “Technology and the Innovation Economy”, Washington, D.C.: Brookings Institution Center for Technology Innovation, October 19, 2011.

¹⁵Darrell M. West, “Improving Health Care through Mobile Medical Devices and Sensors,” Brookings Institution Center for Technology Innovation, October, 2013.

¹⁶Jeffrey Rosen, “The Future of Spectrum”, Washington, D.C.: Brookings Institution Issues in Technology Innovation, August, 2011.

¹⁷Cisco Visual Networking Index, “Forecast and Methodology, 2012–2017,” May 29, 2013.

¹⁸Michael Calabrese, “Solving the ‘Spectrum Crunch’: Unlicensed Spectrum on a High-Fiber Diet,” Time Warner Cable Research Program on Digital Communications, Fall, 2013, p. 15.

¹⁹Robert Matheson and Adele Morris, “The Technical Basis for Spectrum Rights: Policies to Enhance Market Efficiency”, Washington, D.C.: Brookings Institution, March 3, 2011.

²⁰Darrell M. West, Allan Friedman, and Walter Valdivia, “Smart Policy: Building an Innovation-Based Economy”, Washington, D.C.: Brookings Institution Center for Technology Innovation, 2013.

House Committee on Small Business

Hearing: “*Building on the Wireless Revolution: Opportunities and Barriers for Small Firms*”

February 11, 2014

Question for the Record

Rep. Hanna: Question for Michael Feldman of Big Belly Solar.

As I understand, there is value to park services using BigBelly in terms of reduced waste management costs, litter and animal control in parks. Please explain any barriers to entry into the National and State Park services including any improvements or suggestions for what the committee could do to assist increase use of sustainable devices such as BigBelly in parks.

Answer response

Representative Hanna, thank you for the question.

The largest hurdle faced by the parks department is funding for this type of technology equipment. From conversations within the department, we believe the value proposition is well understood, along with the benefits you mentioned. However, the purchase of a BigBelly System is not specifically included during budget cycles and makes it very difficult for the Service to approve the expenditure. Any insight, assistance or introductions to those responsible for the Parks Service budgeting process would help get the BigBelly savings deployed to an already cash depleted Service. We would be thrilled to save tax payer dollars on trash collection in the Parks system.



Computer & Communications
Industry Association
Tech Advocacy Since 1972

Before the

United States House of Representatives
Committee on Small Business

Regarding

“Building on the Wireless Revolution: Opportunities and Barriers for Small Firms”

February 11, 2014

Statement of the
Computer & Communications Industry Association

The Computer & Communications Industry Association (CCIA) represents large, medium-sized, and small companies in the high technology products and services sectors, including computer hardware and software, electronic commerce, telecommunications and Internet products and services—companies that collectively generate more than \$250 billion in annual revenues.¹

CCIA applauds the Committee for convening this hearing. Small businesses in almost every industry sector from clean energy to agriculture to retailing are increasingly relying on fixed wireless connections including WiFi in their daily operations. Cisco predicts that by 2017, WiFi will handle a majority of all data that consumers access from the Internet.²

WiFi runs on unlicensed spectrum that anyone can use as long as they comply with FCC technical rules that prevent interference. Coffee shops, airports and libraries make WiFi available to customers. WiFi provides a platform for techies to “innovate without permission” in their garages and basement offices where start-up companies are often born.

WiFi offloading at the edges of carrier networks makes both wireline broadband and mobile cellular connections faster and more effective.

The exclusively licensed frequencies that mobile carriers use require huge sums for capital investment in spectrum acquisition and expensive and sophisticated regulatory operations that small businesses simply do not have. That’s why unlicensed WiFi is such a valuable alternative. The largest two carriers have already aggregated about three quarters of mobile licensed spectrum all for themselves, making market dominance another barrier to entry even for mid-sized firms. That’s why FCC limits on spectrum holdings are so important ahead of the 2015 incentive auctions of 600 MHz frequencies.

Wireless Internet Service Providers (WISPs) provide small businesses and consumers an independent option for local area

¹ A complete list of CCIA members is available at <http://www.cciainet.org/members>.

² Cisco Visual Networking Index, *Forecast and Methodology, 2012–2017* (May 2013), available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html.

broadband access using WiFi. WISPs are particularly popular in rural areas with little or no landline infrastructure. Regulation is minimal and rates are often very affordable.³

Unfortunately, WiFi is vulnerable to overcrowding and congestion from the deluge of data being consumed and sent by an ever-proliferating sea of devices from smartphones to tablets to industrial monitors and video game consoles.

Engineers are developing creative solutions for making more unlicensed spectrum available. Improving the availability of spectrum through the 5 GHz band can help. Some experts believe that the future of spectrum is about various forms of sharing.⁴ Cognitive radio applications that use smart transmitters and receivers that can detect other signals and avoid interference on the fly are a promising way to increase the efficiency of spectrum use. The FCC is in the process of harvesting spectrum from TV broadcasters who are willing to share a channel with others, move to less valuable frequencies or go off the air and deliver their programming online only. Two Los Angeles TV stations recently announced their testing of a new channel sharing arrangement.⁵

Another promising opportunity is the reallocation of spectrum currently assigned to federal agencies for commercial use instead. Spectrum sharing arrangements could allow for occasional mission critical government uses, while freeing up capacity most of the time for private sector uses. The 3.5 GHz band, for example, is currently underutilized by the military and could be made available for civilian use in many geographic areas.

We urge the Committee to support the FCC and other federal agencies as they preserve existing unlicensed spectrum designations, clear new spectrum for unlicensed use, and adopt simple rules for unlicensed uses that small businesses can rely on when making investments and designing products and systems.



³Richard Thanki, *The Economic Significance of License-Exempt Spectrum to the Future of the Internet* (June 2012), available at <http://download.microsoft.com/download/A/6/1/A61A8BE8-FD55-480B-A06F-F8AC65479C58/Economic%20Impact%20of%20License%20Exempt%20Spectrum%20-%20Richard%20Thanki.pdf>.

⁴Kevin Werbach & Aalok Mehta, *The Spectrum Opportunity: Sharing as the Solution to the Wireless Crunch*, 8 INT'L J. COMM. 128 (2014), available at <http://ijoc.org/index.php/ijoc/article/view/2239/1054>.

⁵Joe Flint, *Two Los Angeles TV stations to test sharing spectrum*, L.A. TIMES, Jan. 28, 2014, available at <http://www.latimes.com/entertainment/envelope/cotown/la-et-ct-two-los-angeles-tv-stations-to-test-sharing-spectrum-20140128,0,5373030.story>.